
QUALITY ASSURANCE PROJECT PLAN

SEPTEMBER 19, 2003

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September 19, 2003

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Subject: Response to Comments on the Draft Final Quality Assurance Project Plan and Submittal of the final Quality Assurance Project Plan for the Yerington Mine Site

Please find attached the final Quality Assurance Project Plan for the Yerington Mine Site. Atlantic Richfield has revised the document pursuant to the comments received from the regulatory agencies on August 19, 2003, as reflected in the following response to comments. As requested in prior comments, the locations within the documents where revisions were made pursuant to a comment is noted in bracketed text within the response.

Introductory Comment

This review was based on information provided in the following documents: EPA Requirements for Quality Assurance Project Plans (QA/R-5, March 2001); Guidance for the Data Quality Objectives Process (EPA QA/G-4, August 2000); Laboratory Documentation Requirements for Data Evaluation (R9QA-004.1, March 2001); Documentation of Data Validation Requirements in Quality Assurance Project Plans, Field Sampling Plans, and Sampling and Analysis Plans (EPA Memorandum, January 14, 2000); Regional Interim Policy for Determination of Volatile Organic Compound (VOC) Concentrations in Soil and Solid Matrices (EPA Memorandum, June 23, 1999); a Response to Comments (RTC) memorandum prepared by Atlantic Richfield Company dated March 12, 2003; and a Quality Assurance (QA) Office memorandum dated January 15, 2003.

The RTC states that G-5 is "a guidance tool and is not required criteria for QAPPs." The RTC also states that G-5 "provides guidance on developing QAPPs that meet EPA specifications for non-EPA conducted projects." It is generally felt that R-5 and G-5 are

essentially the same document. The "requirements" presented in R-5 give an outline, while G-5 provides a more descriptive discussion of what is required in each element and defines the information that EPA considers important in generating data of known quality. It is EPA's position that the elements presented in these documents are required of all parties submitting QAPPs for EPA review and approval. While the format presented in R-5/G-5 is not required, the information specified therein is. (Please note that following the format presented in R-5/G-5 generally expedites the review process.) It is EPA's position that the elements presented in these documents are required of all parties submitting QAPPs for EPA review and approval.

Most of the comments have been adequately addressed. However, several concerns remain. The QAPP cannot be approved until these concerns are addressed. Throughout this report, comments included in the original EPA memorandum are presented in bold type, and evaluations of the responses appear in normal type.

Specific Comments

1A. [General] Most elements required by QA/R-5 are not included in the subject document. Three of the four QA/R-5 groups of elements are not addressed, including Group A, Project Management; Group C, Assessment and Oversight; and Group D, Data Validation and Usability. Some elements required in Group B, Data Generation and Acquisition, are addressed. However, not all elements in Group B are included in sufficient detail, such as Quality Control and Data Management. The Group B elements Sampling Process Design and Non-Direct Measurements are not addressed. It is recommended that the document be written to include all elements required in QA/R-5. If an element is not applicable, this should be stated in the QAPP.

Comment 1A. This comment has been partially addressed. It appears that most elements in Groups A, B and D have been at least cursorily addressed. Many elements have been deferred to site/event specific Work Plans, which is acceptable. (See Concern 1B below.) However, the following elements need to be included in the revised QAPP: A1, Title and Approval Sheet; A3, Distribution List; A4, Project/Task Organization.

Response to Comment 1A. In accordance with EPA QA/R-5, the following Group A elements have been added to the final QAPP: Title and Approval Page [page i]; Distribution List [page ii]; and Project/Task Organization [page iii].

1B. Data quality objectives (DQOs) are not addressed in the QAPP. It is recommended that the QAPP document the seven step DQO process as described in QA/G-4. If the DQO process is or will be described in an associated work plan, the QAPP should indicate this. The description of the DQO process should identify the participants in the DQO process and the primary decision maker.

Comment 1B. This comment has been adequately addressed. The RTC states that a reference to the DQOs has been added to the Introduction, which states that the Closure Scope of Work (SOW) has been attached as Appendix A to this QAPP and provides overall DQOs, background information for the site, and describes the proposed Work Plans for site investigations. The RTC also states that [site/event] specific DQOs will be discussed in the appropriate Work Plans. According to Section 1.4 of the Closure SOW and a conversation with Jim Sickles, the area/task specific Work Plans will be reviewed by the Region 9 QA Office and possibly other agencies as well.

Response to Comment 1B. Comment noted.

1C. The information provided in the QAPP concerning the analytical procedures is limited. It is recommended that the laboratory quality assurance plan, and/or appropriate SOPs, including QC acceptance criteria, be provided. Alternatively, Region 9 has prepared data quality indicator (DQI) tables for most common methods. These can be requested from the QA Office and, if necessary, modified to meet project needs.

Comment 1C. This comment has been partially addressed. DQI tables for some of the analyses listed in Tables 3-1 through 3-4 have been included as Appendix C. However, DQI tables for numerous analyses included on these tables, such as Method 300.0, SW846 Methods 8240 and 8270, to name a few, have not been included. Likewise, several DQI tables have been included (e.g., SW846 Method 8080/8081) for methods not listed on the tables.

Additionally, many of the detection limits listed in the tables are lower than those listed in the DQI tables. For example, on Table 3-2, the detection limit for aluminum, by Method 200.7, is 50 ug/L. The DQI table for Method 200.7 lists the detection limit as 200 ug/L.

The DQI tables and Tables 3-1 through 3-4 should be consistent. The DQI tables can be modified, as necessary, to meet project needs. A DQI table should be included for all requested analyses. If pre-written DQI tables are not available for a given analysis, they should be developed by the plan preparer. Alternatively, once laboratories are selected, the laboratories' quality assurance plans, and/or appropriate SOPs, can be provided for review instead of DQI tables.

It is also not clear how the DQI tables and laboratory QA Plan will be reconciled. As stated in Section 3.0, "prior to acceptance of an analytical laboratory to analyze samples, the laboratory must submit to Atlantic Richfield a comprehensive QC document outlining all methods, types of QC analyses and standards, and acceptance criteria for internal QC, as described in Section 3.6." DQI tables are designed to be prescriptive descriptions of

laboratory analytical requirements. Will prospective laboratories be required to meet the acceptance criteria specified in the DQI tables?

Response to Comment 1C. [Section 2.8, page 38], [Section 3.7, page 45], [Appendix C] The DQI tables in the final QAPP have been modified to include new tables where the pre-written DQI tables are not available for a particular analysis. The revised DQI tables have been compared with Tables 3-1 through 3-4, which have been revised to correspond with the DQI tables. The resulting QC requirements will be provided to the selected laboratory(s) as criteria for their preparation of a written comprehensive laboratory QC document. The QC document prepared by the laboratory will then be compared to the QC requirements, and any discrepancies will be reviewed and discussed with the laboratory.

2A. [Section 2.1.3, Sample Collection - Solids; Table 2-3, Summary of Sample Collection and Storage Parameters; Section 2.1.4, Sample Identification and Preservation - Solids] Section 2.1.3 describes the collection of samples for volatile organic compounds (VOCs) by capping the ends of core samples in tubes or compressing the sample into a container. Region 9 requires collection of samples for VOC analysis using a hermetically sealed sampling container, such as an EnCore sampler. Three discrete containers for each location are required. (Six discrete containers are required for samples designated for laboratory quality control.) A separate aliquot, if a glass jar or other appropriate container, should be provided for percent moisture determination. The Sample Preservation subsection of Section 2.1.4 should also be revised to address preservation of soil samples collected for VOC analysis.

Comment 2A. This comment has been partially addressed. The RTC states that Section 2.1.3 has been modified to include the EnCore sampling device as a possible method for surface and subsurface soil sampling. However, it is not clear if EnCores will be used. It is Regional policy that Method 5035A be followed for the sampling of VOCs. There are several sampling and preservation methods, with associated holding times, listed in this method. A rationale should be provided if Method 5035A will not be followed for the collection of volatile samples.

[Also note: The RTC states that The Region 9 Sampling and Analysis Plan (SAP) Guidance and Template, Version 2, Private Analytical Services Used, R9QA/002.1 does not seem applicable to the Yerington Mine project. This document was provided as an additional reference document. It contains information and "canned" language that may or may not be deemed useful or appropriate for the current project. It was not intended that it would be used "as is" for this project, as its primary use is for "one-time" or limited sampling events.]

Response to Comment 2A. [Section 2.1.3, page 5] Method 5035A will be used for collection and analysis of solids for VOC analysis where practical. It is uncertain which collection device(s) will work best for collection of solid materials at the Yerington Mine Site. The revised QAPP states that samples of the appropriate size for analysis will be collected using a metal or rigid plastic coring tool. The commercially available EnCore™, EasyDraw Syringe™ and Powerstop Handle™ and TerraCore™ sampler coring devices are examples of possible coring tools that are approved under Method 5035A. The appropriate coring tool will depend on the physical nature of the solid materials being collected (i.e., cohesiveness, density, grain size). Any coring tool used and any procedures for sample transfer and preservation will be in accordance with Method 5035A.

For example, gravelly soils will require a larger diameter opening in the coring tool and hard, dense solids may require a metal coring tool as opposed to a plastic coring tool. If a coring device is designed to be used as a storage container (as well as collection device), and is approved by the EPA as conforming with Method 5035A, then initial attempts will be to use such a device. However, if problems arise with this type of collection/storage (e.g., trapped air, inability to collect sample due to physical nature of solids, inadequate amount of sample), then cored samples will have to be transferred from the selected coring device to a VOA vial in accordance with collection and preservation methods in described in Method 5035A. All sampling activities, including a description of the coring tool used during site investigations, will be properly documented per the QAPP.

The 25-gram EnCore sampler appears appropriate for fine to coarse sand, the relatively small (2.3 cm) opening and short (3.3 cm) barrel length may preclude collection of larger, gravelly soils. Two EPA-certified Nevada laboratories indicate that soil samples received in the EnCore device have often been inadequate in terms of sample volume, indicating that air gaps may have been present. Additionally, comments from the EPA on the lack of validity for this device as a storage unit suggests that the EnCore sampler may not be the most appropriate overall choice as a means of collecting solids at the Yerington Mine Site. ("The EnCore sampler has not been thoroughly evaluated by EPA as a sample storage device. While preliminary results indicate that storage in the EnCore device may be appropriate for up to 48 hours, samples collected in this device should be transferred to the soil sample vials as soon as possible, or analyzed within 48 hours."; EPA Method 5035A).

2B. Table 2-3 specifies a 14 day holding time for soil samples collected for VOC analysis. Region 9 recommends a two day holding time unless the sample is frozen or preserved in methanol or with sodium bisulfate.

Comment 2B. Again, Regional policy advocates the use of Method 5035A, which expands on the holding times listed in Table 4-1, Chapter 4 of SW-846.

Response to Comment 2B. [Section 2.8, page 38] Table 2-3 has been revised to reflect two scenarios for VOC sample collection: one using three 40-mL VOA vials and preservative (sodium bisulfate or methanol), and one using a dedicated collection/storage device. The holding times are 14 days and 2 days, respectively.

3. [Table 2-1, Groundwater Field Parameters; Table 2-2, Surface Water Field Parameters] These tables specify Standard Methods 212 for temperature analysis. The Standard Method for temperature is Method 2550.

Comment 3. This comment has been satisfactorily addressed. The tables now list Standard Methods 2550 for temperature analysis.

Response to Comment 3. Comment noted.

4A. [Table 2-3, Summary of Sample Collection and Storage Parameters] The maximum holding time for semivolatile organic compound (SVOC) analysis in water should be revised from 14 days to 7 days.

This comment has been satisfactorily addressed. The table now shows a 7 day holding time for SVOC analysis.

Response to Comment 4A. Comment noted.

4B. The minimum filled container size and maximum holding times for VOCs in soil should be revised per Comment 2A, above.

Comment 4B. This comment has not been addressed.

Response to Comment 4B. [Section 2.8, page 38] Table 2-3 has been revised to reflect two scenarios for VOC sample collection: one using three 40-mL VOA vials and preservative (sodium bisulfate or methanol), and one using a dedicated collection/storage device. The holding times are 14 days and 2 days, respectively.

4C. The footnote for holding time for metals analyses indicate a 24 day holding time for chromium VI. The holding time for hexavalent chromium should be revised to 24 hours. In addition, the sample collected for chromium VI should not be acidified as indicated in Table 2-3.

Comment 4C. This comment has been satisfactorily addressed. The footnote has been revised to show a 24-hour holding time and no acidification for chromium VI.

Response to Comment 4C. Comment noted.

5. [Section 3.0, Laboratory Methods and Procedures] Section 3.0 states the laboratory monitors precision and accuracy through analysis of matrix spike (MS), matrix spike duplicate (MSD), and blank analyses. The criteria for these quality control (QC) samples should be documented in the QAPP. The QAPP should also provide acceptance criteria for initial calibrations, second source calibration checks, and laboratory control samples (LCSs).

Comment 5. This comment is partially addressed. Section 3.0 states that "prior to acceptance of an analytical laboratory to analyze samples, the laboratory must submit to Atlantic Richfield a comprehensive QC document outlining all methods, types of QC analyses and standards, and acceptance criteria for internal QC, as described in Section 3.6. After acceptance, this comprehensive QC document will be added to the QAPP as an appendix." It is unclear from this statement if the laboratory documents will be submitted to the Region 9 QA Office for review. This should be clarified.

This section also states that "available EPA Region 9 data quality indicator tables have been attached to this QAPP as Appendix C as a supplemental reference for assisting in review of laboratory analytical methods." The use of the DQI tables should be clarified, especially given the inconsistencies noted in Concern 1C above.

Response to Comment 5. Please see response to Comment 1C. [Section 3.0, page 40] The initial and subsequent comments are unclear on whether the agencies wish to receive the laboratory QC document. Therefore, the following text has been added: "Upon request from the agencies, the laboratory QC document will be provided".

6A. [Section 3.1, Soil and Sediment Analysis; Section 3.2, Ground and Surface Water Analysis; Section 3.3, Air Analyses] A number of agricultural chemistry samples will be submitted. It is recommended that the specific analytical methods and sources for these methods be identified.

Comment 6A. Only Section 3.1 mentions the analyses of "agricultural chemistry" samples. Table 3-1 lists the analyses that are considered as agricultural chemistry analyses. This comment has been satisfactorily addressed.

Response to Comment 6A. Comment noted.

6B. VOCs are not discussed in Sections 3.1 or 3.3, although VOCs are listed in Tables 31 and 3-4. It is recommended that all analyses that may be used be identified in Sections 3.1, 3.2, and 3.3.

Comment 6B. This comment has been satisfactorily addressed. VOCs have been added to Section 3.1 and deleted from Table 3-4 (as they are not expected to be part of the air analyses).

Response to Comment 6B. Comment noted.

7A. [Table 3-1, Laboratory Methods and Detection Limits for Soil and Sediment Analyses; Table 3-2, Laboratory Methods and Detection Limits for Groundwater Analyses; Table 3-3, Laboratory Methods and Detection Limits for Surface Water Analyses; Table 3-4, Laboratory Methods and Detection Limits for Air Analyses] Tables 3-1 through 3-4 provide detection limits. It is recommended that action levels be provided so proposed detection limits can be evaluated in terms of project requirements.

Comment 7A. The RTC states that "Atlantic Richfield believes that a description of action levels for the analytes listed in the QAPP would be inappropriate for this type of document. As appropriate, these may be addressed in the Final Permanent Closure Plan (FPCP)." It is acknowledged that the action levels determined for the FPCP may or may not be the same as those used to determine cleanup levels. However, it is the reviewer's opinion that a discussion of action levels at this time is not only appropriate, but necessary. Determination of action levels appropriate for the land use (in this case, for example, Region IX Industrial Preliminary Remediation Goals (PRGs)) will affect the selection of analytical methods. In addition, if the selected action levels are below the method detection limits, a discussion of how this will be resolved should be provided. If action levels are not provided, what will the analytical data be compared to in order to determine if additional sampling or site clean up is required?

Response to Comment 7A. [Section 3.7, page 45] Atlantic Richfield maintains that it is inappropriate to describe "action levels" (which typically equate to "cleanup levels") prior to the collection of data that would allow an evaluation of risks, and the development of background concentration ranges. According to the EPA website: "PRGs are not de facto cleanup standards and should not be applied as such. However, they could be used to establish final cleanup levels for a site after a proper evaluation takes place. Chemical concentrations above the PRG would not automatically trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. The PRGs contained in the PRG table are generic; that is, they are calculated without site-specific information. They may be re-calculated using site-specific data. Region 9 PRGs should be viewed as Agency guidelines, not legally enforceable standards."
[EPA website:www.epa.gov/region09/waste/sfund/prg/faq.htm]

However, to provide some level of comfort that the method detection limits (MDL) are adequate, we have included the list of "Analytical Trigger Levels" from the Process

Areas Work Plan. A comparison of MDLs to the analytical trigger levels is added in the Work Plan text and a discussion is provided where any MDLs are higher than the analytical trigger level.

7B. Tables 3-2 and 3-3 indicate total and dissolved analyses will be performed for all inorganic analyses. However, as indicated in Table 2-3, only samples collected for dissolved metals will be filtered. Tables 3-2 and 3-3 should be clarified.

Comment 7B. This comment has not been satisfactorily addressed. The RTC states that samples for total metals analysis will be unfiltered and dissolved metals analyses will be filtered as noted in Table 2-3. However, Tables 3-2 and 3-3 list several other analyses as both total and dissolved under the "Phase" column. Analyses such as alkalinity, hardness, anions (by Method 300.0), pH, temperature, total dissolved solids (TDS), and suspended solids are not normally filtered. In some cases, filtering is part of the method preparation, such as for TDS analysis, but this is not considered as a separate "dissolved" sample.

Response to Comment 7B. [Section 3.7, page 47] Tables 3-2 and 3-3 have been revised to reflect the above comment. "Dissolved" has been eliminated from the "Phase" column for alkalinity, hardness, pH, temperature, TSS, TDS, and turbidity.

7C. The footnote to Table 3-4 incorrectly defines ppm-r as parts per million by volume and XRF as x-ray fractionalization. These definitions should be corrected to ppm-v and x-ray fluorescence, respectively.

Comment 7C. This comment has been satisfactorily addressed. The footnote has been revised appropriately.

Response to Comment 7C. Comment noted.

7D. Note that the column which identifies the parameter or analyte in Table 3-4 also attributes ICP-MS or ICP-OES to the metals. However, the method column specifies XRF. This inconsistency should be resolved. In addition, Table 3-4 specifies TO-14/15 for the analysis of vanadium and zinc. However, TO-14 and TO-15 are organic analytical methods. The table should be corrected.

The table has been revised. The parameter/analyte column no longer includes methods and the methods for vanadium and zinc have been corrected to the XRF method. This comment has been satisfactorily addressed.

Response to Comment 7D. Comment noted.

8. [Section 4.5, Sample Traffic Report, Chain-of-Custody, and QA/QC Summaries] The information to be included on the chain-of-custody should also identify any preservative added and identify the sample(s) designated for laboratory QC.

Comment 8. This comment has been partially addressed. The method of sample preservation has been added to the list. The RTC states that identification of QA samples, such as duplicates and blanks, should not be done. This is true for field duplicates and field blanks, which are sent "blind" to the laboratory. However, the laboratory QC samples referred to above are samples such as matrix spike (MS) and matrix spike duplicate (MSD) samples, which should be made known to the laboratory by identifying them as such on the chain-of-custody form. Sample locations for laboratory QC samples should be selected from locations where moderate levels of contamination are expected.

Response to Comment 8. [Section 4.5, page 54] The final QAPP has been revised to reflect the above comment. Text has been added that requires samples intended for matrix spike and matrix spike duplicates to be indicated as such on the chain-of-custody.

If you have any questions regarding the revised document or the responses to comments, please contact me at 1-406-782-9964 ext. 430.

Sincerely,

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QUALITY ASSURANCE PROJECT PLAN

SEPTEMBER 19, 2003

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QUALITY ASSURANCE PROJECT PLAN
YERINGTON MINE SITE

Atlantic Richfield Company

September 19, 2003

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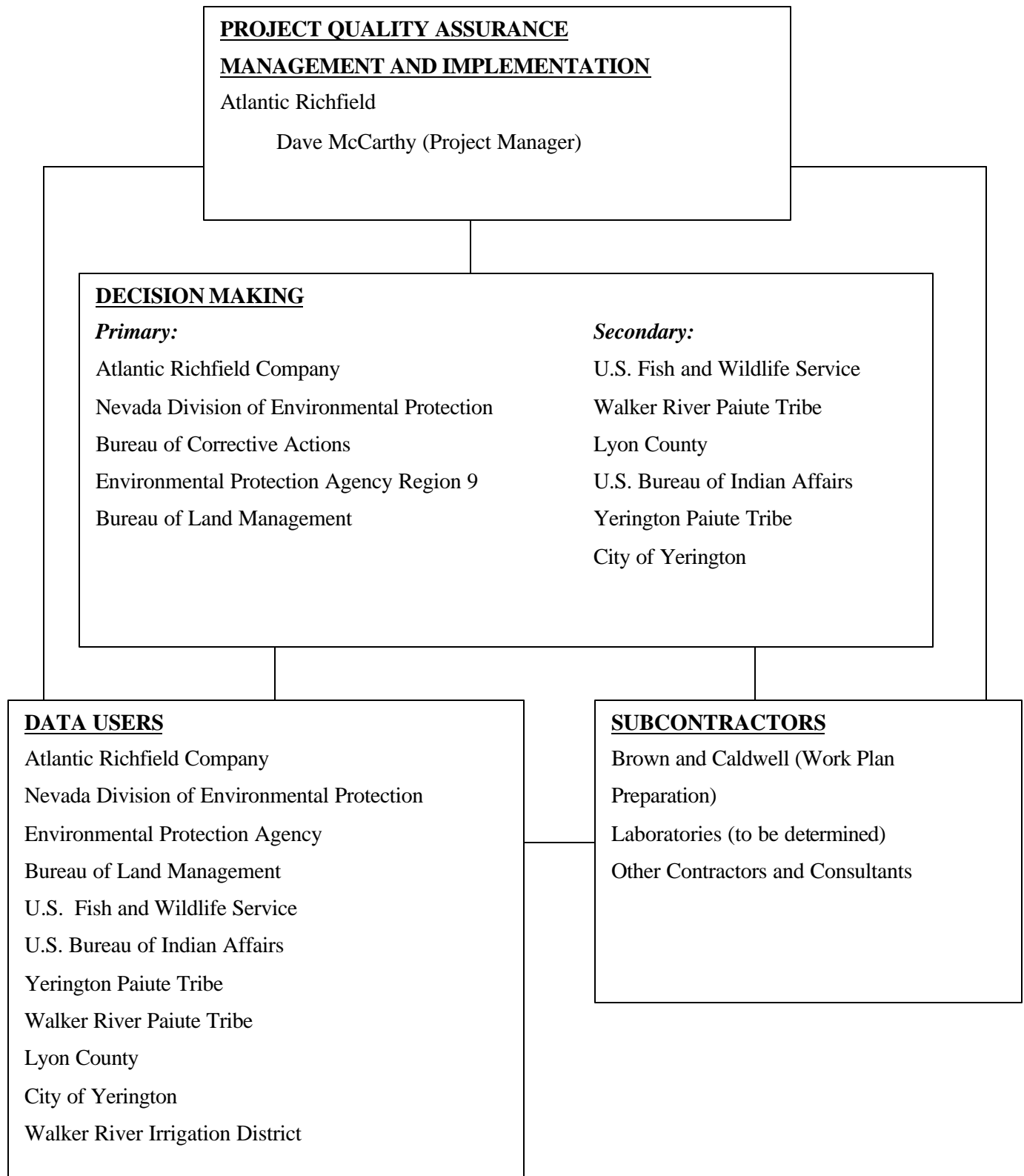
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SECTION 1.0

INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Atlantic Richfield Company to serve as “over-arching” guidance for data collection and analytical activities to be conducted as part of site investigations at the Yerington Mine Site in support of mine closure, pursuant to the Closure Scope of Work (SOW). The SOW (Brown and Caldwell, 2002a) is attached as Appendix A to this QAPP and provides overall Data Quality Objectives (DQO), background information for the site, and describes the proposed Work Plans for site investigations. Each Work Plan includes additional specific site information, and describes quality assurance issues for the specific data collection and analytical activities described in that Work Plan.

The SOW will be conducted pursuant to an Administrative Order on Consent between NDEP and Atlantic Richfield. Regulatory agencies involved in the Yerington Mine Site include the Nevada Division of Environmental Protection – Bureau of Corrective Actions (NDEP), the U.S. Environmental Protection Agency (EPA) and the U.S. Bureau of Land Management (BLM). These agencies and other members of the Yerington Technical Work Group (YTWG) review all submitted Work Plans for content and accuracy, including quality assurance (QA) and quality control (QC) content. Site safety information is also included in each Work Plan.

This QAPP presents general guidance for the Data Collection and Analysis section presented in each Work Plan, which may be modified for specific Work Plans. Topics addressed in this QAPP include:

- Field Methods and Procedures
- Documentation and Shipment of Collected Samples
- Laboratory Methods and Procedures
- Disposal of Sampling Materials

Field Methods and Procedures describes standard operating procedures (SOPs) for the collection of soil, sediment, groundwater, surface water and air samples. These SOPs include a description

of instruments used in the field to measure various parameters and the procedures used to calibrate the instruments, preparation of quality control (QC) samples such as blanks and duplicates, and decontamination procedures.

Documentation and Shipment of Collected Samples describes the procedures involved with accurate recording of field activities and sample and chain-of-custody, proper packaging of samples, and sample handling and transport.

Laboratory Methods and Procedures provides the general requirements necessary to achieve proper laboratory QA/QC for analysis of soil, sediment, groundwater, surface water and air. These requirements include the methods and detection limits necessary for each type of medium collected, the format that will be used to report data analysis results and QA/QC results, and the training and certification for laboratory personnel.

Disposal of Sampling Materials used to collect samples of solids or liquids that are of a single-use type should be properly disposed of or recycled. This includes, but is not limited to, latex sampling gloves, plastic scoops, plastic bags, filters, and bailers. Sampling materials should be checked to see if they can be recycled, or must be disposed of. If the single-use piece of equipment or device has come in contact with any type of hazardous waste, the equipment or device must be disposed of in accordance with regulations for investigation-derived hazardous waste materials.

SECTION 2.0

FIELD METHODS AND PROCEDURES

The following Sections 2.1 through 2.5 provide field methods and procedures for each medium type: soil, sediment, groundwater, surface water, and air. Each section consists of sub-sections that describe:

- Equipment and Calibration
- Field Parameter Measurements
- Sample Collection
- Sample Identification and Preservation
- Decontamination Procedures

Duplicate samples, rinsate blanks, and field and trip blanks are discussed in Section 2.6. Training and Certification for field and laboratory personnel is covered in Section 2.7, and a Summary of Sample Collection and Storage Parameters is provided in Section 2.8.

2.1 Solids Sampling SOP

Rationale for selecting solids or soil sampling locations will be presented in each Work Plan.

2.1.1 Equipment and Instrument Calibration - Solids

The only equipment anticipated for collection of solids are excavation and collection devices (e.g. hand shovel, core borer, hand auger, piston collector, split-spoon). The use of field instruments for the purpose of screening for sample collection is not anticipated. However, in the event that a field instrument is used for screening purposes, manufacturer-supplied calibration information for each field instrument will be used as guidance.

Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed at a minimum of every 10 samples and at the end of the day, using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at

different sample locations under different subsurface conditions and target constituent concentrations. Re-calibration of the field instrument will be conducted whenever the measured value of the calibration standard is +/- 5 percent of the actual value of the standard being measured (EPA Method 25E). Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.1.2 Field Parameter Measurements - Solids

Although field screening is not anticipated for the project, if any field screening measurements are collected, they will be recorded on the appropriate excavation log and in the field notebook during the investigation. Logs of screening measurements will be used together with laboratory results to estimate the vertical extent of impact to the subsurface.

2.1.3 Sample Collection - Solids

Excavation Sampling

Soil samples will be collected from each excavation by grab sampling of the backhoe bucket or from the hand auger or shovel. Sample collection depth is specific to each Work Plan. Sample collection locations will depend on the overall excavation depth, constituents of concern, and ease of sampling, and will be conducted in accordance with the individual Work Plan. Samples collected from a hand auger or from a backhoe or excavator bucket will be collected using a clean, decontaminated trowel or small hand shovel. Transfer of the samples from the trowel or shovel to the sample container will be accomplished with minimum disturbance of the solids. A minimum of one soil sample per sample location will be submitted for laboratory analysis.

Point Sampling

Soil samples will be collected from each point location by a discrete interval sampling technique such as borehole drilling in conjunction with split-spoon sampling or subsurface probe sampling. Sample collection intervals will depend on the overall sampling depth, constituents of concern, and ease of sampling, and will be conducted in accordance with the individual Work Plan. Collected soil samples will be transferred by hand from the split-spoon, probe casing, or other collection device to the sample container, minimizing disturbance of solids. Hands will be covered with clean, disposable, latex gloves. All collection equipment will be decontaminated

between collection points.

Composite Samples

Each discrete solids sample that is combined with others into a single composite sample will first be either (a) weighed on a scale or (b) measured in a graduated volumetric container, then transferred to a plastic or metallic mixing tray. The combined equal-weight or equal-volume aliquots will be mixed together thoroughly with the trowel or hand shovel.

Collected samples will be placed in labeled containers appropriate for each analysis. (Refer to Section 2.1.4 for labeling protocols).

VOC Samples

Samples will be collected and analyzed in accordance with EPA Method 5035A (Closed System Purge and Trap and Extraction). The most important procedure in sampling solids containing volatile organic compounds (e.g., petroleum products or solvents) is to maintain the sample in an intact form from the time of collection to analysis if at all possible. Accordingly, all initial attempts at collecting samples of the appropriate size for analysis will be conducted using (1) a self-sealing collection/storage device, or (2) a metal or rigid plastic coring tool and transfer to Volatile Organic Analysis (VOA) vials. As a last resort for solids which can not be collected using either of these two methods, excavation and transfer to VOA vials will be permitted. All sampling collection procedures, collection and/or storage devices, and any procedures for sample transfer and preservation must be in accordance with Method 5035A (attached).

Collection/Storage Device. The commercially available EnCore™, EasyDraw Syringe™ and Powerstop Handle™ and TerraCore™ sampler coring devices are examples of possible collection/storage devices. The exact device will depend on the physical nature of the solid materials being collected (i.e., cohesiveness, density, grain size). Larger, gravelly solids or extremely dense solids may require a larger diameter opening in the device, or may preclude the use of a collection/storage device entirely. Three replicate samples (using three devices) must be collected for each sample submitted. No preservatives are used, and the sample must be analyzed within 48 hours from collection.

Coring Tool and Transfer to VOAs. Gravelly or dense solids may require a metal or plastic coring tool. Cored samples must be extruded from the selected coring tool to a VOA vial in accordance with collection and preservation methods in described in Method 5035A. Care must be exercised to keep the sample intact as much as possible. The extruded core is transferred into a laboratory pre-weighed (tared) VOA vial with septum cap. Four such vials are collected for each sample submitted. Unpreserved VOA samples must be analyzed within 48 hours of collection. VOAs preserved with methanol must be analyzed within 14 days from collection.

Excavation and Transfer. When there is absolutely no way to collect an intact solid sample using the above collection/storage device or coring tool methods, the person collecting the sample should expose the sample to the air for as short an amount of time as possible. Care should be exercised to maintain the sample as intact as possible. For volatile constituents analysis the collected material will be obtained using a stainless steel spatula or scoop. For some solids, a wide-bottom funnel or similar channeling device may be necessary to facilitate transfer to the VOA vial or container. The excavated solids are transferred into a laboratory pre-weighed (tared) VOA vial with septum cap. Four such vials are collected for each sample submitted. Unpreserved VOA samples must be analyzed within 48 hours of collection. VOAs preserved with methanol must be analyzed within 14 days from collection. Losses of VOCs using this procedure are more likely than the coring tool or collection/storage device methods, and collection using this procedure should be used as a last resort.

All soil samples to be analyzed will be immediately placed into insulated chests with ice for transport under chain-of-custody to a Nevada-certified analytical laboratory. Soil field data and sample collection intervals will be recorded on the appropriate excavation log and in the field notebook during the investigation. Soil data will include soil color, moisture content, consistency, and a visual estimate of Unified Soil Classification.

Table 2-3, Section 2.8, outlines the proper amounts and containers for solids collection for various analyses.

2.1.4 Sample Identification and Preservation - Solids

Sample Identification

Sample labels will be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample substance type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample is collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, hypothetical soil sample collected below the North Evaporation Pond during the third sampling event at the fourth location sampled might be labeled: 003NEP004. Blanks and duplicate samples will be labeled in the same fashion as regular samples, with no indication of their contents. For example, the duplicate sample to the one stated above might be labeled: 003NEP006, with documentation in the field notebook that 003NEP004 and 003NEP006 are duplicate samples.

Sample Preservation

Unless the sample is to be analyzed for VOC, including gasoline, soil samples will generally not require addition of preservatives. The types and quantities of solids preservatives for VOCs are addressed in the Sample Collection and Storage section of this QAPP (Section 2.8), and in the individual methods for each analysis (Appendix C).

2.1.5 Decontamination Procedures - Solids

The following is a procedure that has been recommended by the EPA Region IX for the decontamination of sampling equipment:

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse and distilled water rinse (only when sampling for metals)
- Pesticide-grade solvent (reagent grade hexane) rinse and distilled water rinse (only when sampling for organic compounds)

All soil collection (sampling) equipment will be decontaminated between each excavation. For soil sampling, disposable scoops will be used or sampling equipment will be decontaminated between each sampling location. In general, sampling equipment will be hand-washed with a solution of tap water and Alconox detergent, then double-rinsed in clean tap water. The decontamination wash will be accomplished with clean buckets, filled half to three-quarters full as follows:

- Bucket 1: Tap water with non-phosphate detergent such as Alconox
- Bucket 2: Clean tap water or distilled water
- Bucket 3: 0.1N nitric acid rinse (metals) or hexane rinse (organic compounds)
- Bucket 4: Distilled water

Equipment decontamination consists of the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by scrub-washing in Bucket #1.
- Rinsing in Bucket #2, followed by rinsing in Bucket #3 (if applicable), then rinsing in Bucket #4. Change the water periodically to minimize the amount of residue carried over into subsequent rinses.

Washing and rinsing solutions considered to be investigation-derived waste will be properly managed. As appropriate, used gloves and other disposable PPE may also be handled as investigation-derived waste.

Decontamination of large equipment used for soil sampling, such as the backhoe bucket, may be accomplished using the following general steps:

- Removal of gross (visible) contamination by brushing or scraping.
- Removal of residual contamination by spraying with a hose sprayer.
- Scrub-brushing with a mixture of tap water and non-phosphate detergent such as Alconox.
- Rinsing with a hose sprayer.

Wash and rinse water from large equipment decontamination will be allowed to settle on the ground.

2.2 Sediment Sampling SOP

Rationale for selecting sediment sampling locations will be presented in each Work Plan.

2.2.1 Equipment and Instrument Calibration - Sediments

The only equipment anticipated for collection of solids are excavation and collection devices (e.g. hand shovel, core borer, hand auger, piston collector, split-spoon). The use of field instruments for the purpose of screening is not anticipated.

However, in the event that a field instrument is used for screening purposes, manufacturer-supplied calibration information for each field instrument will be used as guidance in calibrating. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed at a minimum of every 10 samples and at the end of the day, using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different sediment conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

2.2.2 Field Parameter Measurements - Sediments

Refer to Section 2.1.2, Field Parameter Measurements - Solids for QA procedures relative to field parameter measurements for sediments.

2.2.3 Sample Collection - Sediments

Ideal sediment sampling locations in flowing channels will be backwater areas if they exist, near the inner bank of a channel bend, near the bank in straight portions, or near pilings or other flow obstructions. These areas generally have the slowest moving water for a given reach and sediments will tend to settle here. Sediment sampling will progress from downstream to upstream locations in order to reduce the impact of sediment disturbance on subsequent samples (EPA, 1995).

At each sample location, sub-samples will be collected using one of two methods, in order of preference:

1. Using a core boring tool or piston-type sampler to retrieve a continuous core sample from zero to six inches below ground surface at each location and mixing that core sample into a representative composite sample, or if that method is not possible.
2. Using a trowel or small hand shovel to retrieve samples at depths of two, four, and six inches below ground surface, and combining them into one composite sample for that location.

The piston-type hand sampler consists of an approximately 3-inch diameter solid steel tube with a T-handle welded to the top. The hand-held sampler is pushed and twisted into the sediments while the plunger is drawn upwards. When the sampler is 6 inches into the sediments, it will be slowly withdrawn.

The following is a brief summary checklist for sediment sampling, based on the sampling protocol outlined above:

1. Select the sample location after surface water sample has been collected. Be certain to not collect samples from where ground surface has been disturbed, either by previous human or animal activity, or by where the sampler has walked.
2. Wear a new pair of latex gloves prior to each sampling location. Place indelible identifying label on the container.

For core boring samples:

3. Push the core boring barrel straight down into the bank or exposed channel sediments to a depth of six inches.
4. Transfer the extracted core sample from the barrel to the shallow HDPE mixing pan by carefully pushing out the entire solid medium in the barrel, using a gloved hand or decontaminated instrument.

For hand-dug samples:

5. Using a clean or disposable trowel or small hand shovel, dig straight down into the bank or exposed channel sediments forming an approximate three-inch diameter cylinder from zero to six inches below ground surface.
6. Transfer all of the soil from the zero to six inch interval to a clean shallow HDPE mixing pan.

Mixing and transfer:

7. Thoroughly mix the core sample or sample interval using the trowel or small hand shovel.

8. Using the trowel, transfer the resulting composite sample from the mixing pan to the labeled laboratory sample jars. Seal each jar with a teflon-lined lid.
9. Place each sealed jar into a zip-loc bag and store in an insulated ice chest.
10. Decontaminate trowel or hand shovel and mixing pan, and dispose of gloves and other single-use sampling equipment as described in Section 2.2.5.

If sediment is to be analyzed for volatile compounds, the samples to be analyzed for volatile compounds should not be homogenized but rather transferred directly from the sampler into the sample container (EPA, 1995). Refer to Section 2.1.3 for further procedures involving collection of samples for analysis of volatile constituents.

2.2.4 Sample Identification and Preservation - Sediments

Sample Identification

Sample labels will be completed with a permanent waterproof marker and attached to each laboratory sample container before each sample is collected, and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample substance type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample is collected. This field identification number will consist of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, the hypothetical sediment sample collected in the Wabuska Drain during the first sampling event at the fourth location sampled might be labeled: 001WD004. Blanks and

duplicate samples will be labeled in the same fashion as regular samples, with no indication of sample location.

Sample Preservation

Unless the sample is to be analyzed for VOC, including gasoline, soil samples will generally not require addition of preservatives. The types and quantities of solids preservatives for VOCs are addressed in the Sample Collection and Storage section of this QAPP (Section 2.8), and in the individual methods for each analysis (Appendix C).

2.2.5 Decontamination - Sediments

Refer to Section 2.1.5, Decontamination - Solids Sampling for QA procedures relative to decontamination of sediment sampling equipment.

2.3 Groundwater Sampling SOP

The following procedures describe standard operation procedures for collection of groundwater samples. Groundwater samples are typically discrete samples, collected for the purpose of evaluating parameters at a particular well location; as such, groundwater samples are not composited. Particular attention will be given to decontamination procedures, since there exists a high potential for cross-contamination and equipment contamination with water sampling.

2.3.1 Equipment and Instrument Calibration - Groundwater

Equipment and instruments used for groundwater sampling and field monitoring may include, but are not limited to:

- Temperature/pH/conductivity (probe/meter)
- Dissolved oxygen (probe/meter)
- Groundwater level indicator (probe/audible indicator)
- Purging devices (e.g. pumps or bailers)
- Sampling devices (e.g. pumps or disposable bailers)

Manufacturer-supplied calibration information for each instrument will be used as guidance in

calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed at a minimum of every 10 samples and at the end of the day, using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different groundwater conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

The pH probe/meter will be calibrated with a three-point buffer solution procedure (4.0, 7.0, and 10.0), in accordance with the manufacturers calibration instructions. The conductivity probe/meter will be calibrated with a standardized solution appropriate for the range of actual field measurements, in accordance with the manufacturers calibration instructions. Dissolved oxygen meters will be checked for accuracy by comparing the measurement of distilled water that has been setting for at least 24 hours at the sample location (ambient-saturated oxygen condition) and elevation (above mean sea level) to a published reference chart that provides standard values for oxygen-saturated water at elevation (or pressure) and temperature. Such charts may be included with the instrument, or are available from published sources such as *Standard Methods for Examination of Water and Wastewater*.

Instruments that measure temperature will be checked against a separate temperature device such as a standard laboratory-grade thermometer. Re-calibration of a particular field instrument will be conducted whenever the measured value of the calibration standard is +/- 5 percent of the actual value of the standard being measured (EPA Method 25E). If it is not possible to re-calibrate an instrument with error outside +/- 5 percent (e.g., some temperature-reading instruments), the instrument will be sent back to the manufacturer for re-calibration or replacement.

2.3.2 Field Parameter Measurements - Groundwater

Field measurements of groundwater at monitor wells may include static groundwater elevations, dissolved oxygen, pH, electrical conductivity and temperature. The field parameter

measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments.

Prior to sampling at each monitor well, the pH, dissolved oxygen, temperature, and electrical conductivity probe(s) will be calibrated and the conductivity probe will be checked with a standard (Section 2.3.1). Proper operation of the groundwater elevation probe will be checked prior to use by immersing the probe in water to ensure the audible signal is produced. The methods and minimum detection limits of the pH, dissolved oxygen, temperature, and electrical conductivity devices are shown below:

Table 2-1. Groundwater Field Parameters		
Parameter	Method	Detection Limit
Conductivity	EPA 120.1, meter	1.0 $\mu\text{S}/\text{cm}$
Dissolved Oxygen	EPA 360.1, probe	0.1 mg/l
PH	EPA 150.1, meter	0.1 standard units
Temperature	Standard Methods 2550, Thermometer	0.1 $^{\circ}\text{C}$

Field parameters will be measured in one day to limit error in calculating hydraulic gradient or flow direction due to potential diurnal fluctuations in groundwater elevation, and will be recorded in a bound field notebook. Measurement of field parameters in monitor wells will occur in order of least contaminated to greatest contaminated, as determined by the previous quarter's laboratory analytical results. All equipment used to measure depth-to-water and other physical parameters in each well will be decontaminated between wells by washing in an Alconox detergent solution with subsequent clean-water rinse.

2.3.3 Sample Collection - Groundwater

Field measurements will be collected in monitor wells prior to groundwater sample collection (Section 2.3.2). Monitoring wells will be purged using either a submersible pump or clean, disposable Teflon bailer, depending on depth-to-water, total depth of the well, and well diameter. Domestic wells will be sampled at the tap or other source on the property. The equipment and purging method used for monitor wells will be noted on each field data sheet.

During purging, pH and electric conductivity will be monitored with a calibrated, portable field instrument in order to determine stabilization of these parameters between each purged well casing volume. Three consecutive measurements that display stable values of pH and conductivity will be recorded prior to sampling. Stable value is defined as pH that does not vary by more than 0.2 pH units, and specific conductance that does not vary by more than 10 percent from reading to reading (EPA, 1995).

A minimum of three casing volumes will be purged from each well. If pH and conductivity have not stabilized after five casing volumes have been purged (30 minutes if the purge volume is not known), purging will cease, a notation will be recorded in the field logbook and samples will be collected. If a well is purged dry, no sample will be collected until it has recharged to within 80 percent of its original depth-to-water, or no more than 24 hours. For large-capacity wells, samples may be collected after field parameters have stabilized, prior to the purging of three casing volumes.

After pH and conductivity have stabilized, a groundwater sample will be collected using a disposable Teflon bailer or discharge from the submersible pump. If samples are to be analyzed for volatile organic compounds, a pump flow rate of less than 100 milliliters per minute is recommended to minimize volatilization (EPA, 1995). Vials for volatile organic compound analysis will be filled first to minimize aeration of water in the well. The sample will be decanted into an appropriate sample container depending on the required analysis. Both filtered samples for dissolved metals and, for selected monitor wells and domestic wells, unfiltered samples for total metals will be each collected in 500-milliliter (mL) bottles. Non-metals samples will be collected in 1,000-mL bottles, unfiltered, with no acid preservation. Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

Immediately following collection, samples will be placed into an insulated cooler chilled with ice to an approximate temperature of four degrees centigrade. The samples will then be transported to the analytical laboratory via overnight mail or personal delivery.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.3.4 Sample Identification and Preservation - Groundwater

Sample labels will be completed and attached to each laboratory sample container prior to groundwater collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification (well location)
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical groundwater sample collected during the third sampling event at monitor well MW-4 would be labeled: 003MW004. Blanks and duplicate samples for quality assurance will be labeled in the same fashion, with no obvious indication of their sample location or quality. For example, the duplicate sample to the one stated above might be labeled: 003MWD111, with a field notebook note that this identification number corresponds to 003MW004.

The following sample preservation methods will be followed for collected groundwater samples:

- **Total Metals:** A test vial will be prepared by adding a measured volume of nitric acid (HNO₃) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HNO₃ will then be added to the sample vials prior to the addition of the sample. Check the pH by pouring a very small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- **Dissolved Metals:** Filter sample through a 0.45 micron filter using a disposable form of inline filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- **Volatile organic compounds:** A test vial will be prepared by adding a measured volume of hydrochloric acid (HCl) to a typical sample container of groundwater, to determine the amount of acid needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample. The vials will be filled, capped, then inverted and checked for air bubbles to ensure zero headspace. If a 1/8-inch or larger air bubble appears, the vial contents will be emptied into the measured container, the vial discarded, and a new sample will be collected. Cool the sample to 4°C with ice immediately after sample collection.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.3.5 Decontamination - Groundwater

The following is a procedure that has been recommended by the EPA Region IX for the decontamination of sampling equipment:

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- 0.1 N nitric acid rinse and distilled water rinse (only when sampling for metals)
- Pesticide-grade solvent (reagent grade hexane) rinse and distilled water rinse (only when sampling for organic compounds)

Buckets will be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets will be filled half to three-quarters full as follows:

Bucket 1: Tap water with non-phosphate detergent such as Liqui-Nox.

Bucket 2: Clean tap water or de-ionized water.

Bucket 3: Clean tap water or de-ionized water.

After the decontamination area is set up, equipment decontamination of soil sampling equipment is comprised of four general steps:

1. *Removal of gross (visible) contamination.* Gross contamination generally applies to soil sampling equipment, which may have significant residue clinging to the piece of equipment. This can be removed by drybrushing or scraping or water rinse.
2. *Removal of residual contamination.* All sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished. Removal of residual contamination consists of the following steps:
 - a. Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.
 - b. Place the item in the second bucket (clear water rinse – tap or distilled water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.
 - c. Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.
 - d. Place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).
3. *Prevention of recontamination.* After the decontamination process, equipment will be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.
4. *Disposal of wastes associated with the decontamination.* All washing and rinsing solutions are considered investigation derived waste and will be containerized. After use,

gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Decontamination of purging equipment is performed between each well by submerging and scrubbing the outside of the pump and associated hosing in an Alconox detergent bath, then twice rinsing the outside of the pump in deionized water. At least five gallons of Alconox detergent solution and then five gallons of deionized water are run through the internal portion of the pump to reduce the potential of cross contamination between wells.

All purged groundwater will be poured on the ground on-site and decontamination water will be collected in approved containers and properly disposed of or recycled. For each groundwater sampling event, the information described in Section 4.0, will be recorded.

2.4 Surface Water Sampling SOP

The following procedures describe standard operation procedures for collection of surface water samples. Surface water samples are typically discrete samples, collected for the purpose evaluating parameters at a particular location along a body of water, and are not typically composited. Particular attention will be given to decontamination procedures, since there exists a high potential for cross-contamination and equipment contamination with water sampling of any kind.

2.4.1 Equipment and Instrument Calibration - Surface Water

Equipment and instruments used for surface water sampling and field monitoring may include, but are not limited to:

- Temperature/pH/conductivity (probe/meter)
- Dissolved oxygen (probe/meter)
- Flow rate (flumes or probe/meter)
- Sampling devices (e.g. pumps or disposable bailers)
- Tape measure
- Waders or hip boots

Manufacturer-supplied calibration information for each instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed at a minimum of every 10 samples and at the end of every day, using the same standard solutions or test used to calibrate. The purpose of the drift check is to assess the loss of accuracy that often occurs when measurements are performed at different sample locations under different surface water conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

The pH probe/meter will be calibrated with a three-point buffer solution procedure (4.0, 7.0, and 10.0), in accordance with the manufacturers calibration instructions. The conductivity probe/meter will be calibrated with a standardized solution appropriate for the range of actual field measurements, in accordance with the manufacturers calibration instructions. Dissolved oxygen meters will be checked for accuracy by comparing the measurement of distilled water that has been setting for at least 24 hours at the sample location (ambient-saturated oxygen condition) and elevation (above mean sea level) to a published reference chart that provides standard values for oxygen-saturated water at elevation (or pressure) and temperature. Such charts may be included with the instrument, or are available from published sources such as Standard Methods for Examination of Water and Wastewater.

Instruments that measure temperature will be checked against a separate temperature device such as a standard laboratory-grade thermometer. Re-calibration of a particular field instrument will be conducted whenever the measured value of the calibration standard is +/- 5 percent of the actual value of the standard being measured (EPA Method 25E). If it is not possible to re-calibrate an instrument with error outside +/- 5 percent (e.g., some temperature-reading instruments), the instrument will be sent back to the manufacturer for re-calibration or replacement.

2.4.2 Field Parameter Measurements - Surface Water

Field measurements of surface water in rivers, streams, ponds, or other forms of open containment may include some combination of dissolved oxygen, pH, electrical conductivity and temperature, depending on the nature of the water source. The exact types of field measurements will be specified in the individual Work Plan. The field parameter measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments.

Prior to sampling, the pH, dissolved oxygen, temperature, and/or electrical conductivity probe(s) will be calibrated and the conductivity probe, if used, will be checked with a standard (Section 2.4.1). The methods and minimum detection limits of the pH, dissolved oxygen, temperature, and electrical conductivity devices are shown below:

Table 2-2. Surface Water Field Parameters		
Parameter	Method	Detection Limit
Conductivity	EPA 120.1, meter	1.0 μ S/cm
Dissolved Oxygen	EPA 360.1, probe	0.1 mg/l
pH	EPA 150.1, meter	0.1 standard units
Temperature	Standard Methods 2550, Thermometer	0.1 °C

Field parameters will be measured in one day to limit error in calculating flow rates due to potential diurnal fluctuations in river or stream elevation, or in diurnal fluctuations of temperature and dissolved oxygen. All measurements will be recorded in a bound field notebook. The physical measurements will be recorded to the accuracy allowed by the measurement method and equipment, with particular attention being given to proper calibration of instruments. Instrument accuracy limits will be specified in the results section of the Data Summary Report.

Measurement of field parameters in ponds or other open containment will occur in order of least contaminated point to greatest contaminated point, as estimated by observation, or determined by

previous laboratory analytical results, if available. Field parameters will be measured after each sample collected, to avoid possible cross-contamination at the sample location. All equipment used to measure physical parameters at each sampling point will be decontaminated between points by washing in an Alconox detergent solution with subsequent clean-water rinse.

Measurements of surface water conductivity, dissolved oxygen, pH, and temperature will be collected from two to three inches below the water surface, unless specified otherwise in the individual Work Plan. Temperature and conductivity surface water measurements will be collected by placing the test cup and probe below the water surface. Measurements of surface water pH, dissolved oxygen and electrical conductivity will be collected by placing the probe below the water surface, allowing the pH value to stabilize, and recording the value. In rivers, streams, or ponds, care will be taken to prevent disturbance of sediment or soil along the bank that could roll down into the water.

Channel Flow

Channel flow will be measured with either a cutthroat flume or Pygmy current meter. The flume will convey a flow of about 2.3 cubic feet per second (CFS) without overtopping. The flume will be temporarily placed in the conveyance, leveled and allowed to equalize flow between the inlet and outlet prior to recording the stage in the flume. A typical flume has a staff gage installed on the flume that is scaled in 0.01-foot increments. The recorded stage is converted to flow rates using a rating table.

An eight-inch flume will be used for flow measurements in the range from 0.2 gpm to 1000 gpm when site conditions permit. If lower tolerances are required, then a one to four-inch flume may be used. The one-inch flume is capable of flow measurements down to 0.0225 gpm.

For flows greater than 2.3 CFS a pygmy current meter will be used. to determine flow rate. The meter is a rotating element type in which the operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter rotor.

In general, the 6/10 method will be used for measuring flow rate (Geology Labs, 2000), whereby the velocity measurement at 6/10 of the total vertical depth of the channel from the channel surface is used to measure velocity. This method applies to flow depths up to 2.5 feet deep. In deeper water the 2/10 and 8/10 method may be applied, whereby two measurements at each depth are used to obtain an average channel velocity.

At the specified channel cross section the top width of the flowing channel will be measured then divided into equal increments for determining incremental channel width, depth and velocity. The mid-point method will be used for determining average channel velocity. The product of the width and depth provides the area for each section and the current meter yields the velocity for the section. The sum of the increments equals the total flow.

2.4.3 Sample Collection - Surface Water

Samples at each monitoring point will be collected prior to recording field parameters or measuring flow. Unless specified otherwise in the individual Work Plan, high-density polyethylene (HDPE) bottles, supplied the analytical laboratory, will be used to collect surface water samples. Prior to collecting the actual lab sample, the collection bottle will be marked with a collection sequence number. In moving water, the water samples will be collected slightly “upstream” of where the person doing the sampling is standing, to prevent disturbed sediment from contaminating the sample.

Water samples will be collected from just below the water surface, taking care to avoid sampling where surface debris is present. Care will also be taken to prevent disturbance of bed sediment or soil along the banks of rivers, streams, or ponds that could roll down into the water. Latex gloves will be used to handle bottles and equipment throughout each sampling event. The gloves will be changed between each sample point.

Sample collection containers, preparation, and preservation is outlined in Table 2-3, Section 2.8. Both total metals (unfiltered) and, dissolved metals (filtered) samples will be each collected in 500-milliliter (mL) bottles. Non-metals samples will be collected in 1,000-mL bottles,

unfiltered, with no acid preservation.

The following is a brief summary checklist for surface water sampling, based on the sampling protocol described above:

1. Locate accessible portions of the body of water where access and sampling activities create minimal disturbance to the water that will be sampled. In streams and rivers, flowing water is required for sampling.
2. Wear a new pair of latex gloves prior to each sampling point. Place an indelible identifying mark or label on the container. Fill container directly by carefully submerging the mouth of the container two to three inches below the water surface. In flowing water, sample into the flow, with the body of the container and hand downstream of bottle mouth. Adjust the container position as needed to obtain a nearly full container (a small head-space may remain).
3. Be sure to stand downstream from the sample container, to avoid collecting sediment disturbed by your movement.
4. Unfiltered Samples: Collect the sample in same manner as #2, rinse the cap in flow or just below water surface, seal the container, and wipe off the outside with a clean paper towel.
5. Filtered Samples: Collect the sample in the same manner as #2, and perform steps #2 and #3 for an additional empty bottle to filter into. Using an in-line pump with a new 0.45-micron filter and new line, carefully filter the water from the full bottle into the empty one. Perform this activity away from the body of water, taking care not to allow unfiltered water present on surface exteriors to enter the filtered water bottle. Use a fresh pair of gloves for the filtering procedure. Replace the cap, seal the container, and wipe off the outside with a clean paper towel.
6. Measure and record flow, pH, conductivity, and temperature, as appropriate.
7. Preserve all samples as appropriate, complete documentation, package and ship or transport samples.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.4.4 Sample Identification and Preservation - Surface Water

Sample labels will be completed and attached to each laboratory sample container after each sample is collected, to avoid saturation of the labels during water collection. Strict attention will be given to ensure that each sample label corresponds to the collection sequence number marked

on the bottle prior to sample collection. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preparation and preservative
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical sample collected at the Yerington Pit Lake during the third sampling event at the first location sampled would be labeled: 003YPL001. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their sample location (Section 2.6).

The following sample preservation methods will be followed for collected surface water samples. Only laboratory-grade acid will be used for preservation of sample water.

- Total Metals: A test vial will be prepared by adding a measured volume of nitric acid (HNO_3) to a typical sample container of surface water, to determine the amount of acid needed to lower the pH to less than 2. Based on this amount, the appropriate amount of HNO_3 will then be added to the actual sample containers prior to the addition of the sample. Samples will be collected from the water body with a separate clean wide-mouth container, and poured into the containers containing the acid. Check the pH by pouring a very small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.

- Dissolved Metals: After collection of the water using a clean separate wide-mouth collection container, filter sample through a 0.45 micron filter using a disposable form of inline or vacuum filter immediately after sample collection. Following filtration, add nitric acid to a pH less than 2, or to a container with pre-measured acid based on testing described above. Check the pH by pouring a small amount of sample into the bottle cap and checking the pH with pH paper. Discard the liquid in the cap after checking the pH. Cool the sample to 4°C with ice immediately after sample collection.
- Volatile organic compounds: The above procedures for acid preservation will be followed for addition of hydrochloric acid (HCl). Each sample vial will be filled, capped, then inverted and checked for air bubbles to ensure zero headspace. If a 1/8-inch or larger air bubble appears, the vial contents will be emptied into the measured container, the vial discarded, and a new sample will be collected. Cool the sample to 4°C with ice immediately after sample collection.

Table 2-3, Section 2.8, outlines sample collection containers, collection amounts, holding times, and preservation methods for various analytes.

2.4.5 Decontamination Procedures - Surface Water Sampling

For surface water sampling, all sampling equipment will be disposable or one-time use, with the exception of the in-line pump. Although the pump should not normally come in contact with water, decontamination of the pump between sample locations will occur using decontamination water dedicated for the pump. For decontamination of pumps and field instruments, refer to Decontamination Procedures for groundwater (Section 2.3.5).

2.5 Air Sampling SOP

The rationale for air quality sampling is presented in the Fugitive Dust Work Plan.

2.5.1 Equipment and Calibration - Air

In general, equipment and instruments used for air sampling and monitoring may include, but are not limited to:

- Temperature (sensor/meter)
- Organic carbon vapors (e.g., Photo-ionization detector)
- Outdoor air sampling devices (e.g. personal air pumps, PM-10 samplers)

Manufacturer-supplied calibration information for each instrument will be used as guidance in calibrating field devices. Each field instrument will be calibrated prior to use and a drift check performed after sampling is completed. The drift check will be performed at a minimum of every 10 samples and at the end of each day, using a volumetric rate method and/or gas standards used to calibrate. The purpose of the drift check is to assess the change in flow or the loss of instrument sensitivity that often occurs when measurements are performed at different sample locations under different ambient air conditions and target constituent concentrations. Instrument calibration information and instrument accuracy limits will be recorded in the field notebook and presented in the Data Summary Report.

Instruments that measure temperature will be checked against a separate temperature device such as a standard laboratory-grade thermometer. The PID instrument will be calibrated with laboratory-grade span gas (e.g., 100 ppm-v isobutylene) in accordance with the manufacturers calibration instructions. Re-calibration of a particular field instrument will be conducted whenever the measured value of the calibration standard is ± 5 percent of the actual value of the standard being measured (EPA Method 25E). If it is not possible to re-calibrate an instrument with error outside ± 5 percent (e.g., some temperature-reading instruments), the instrument will be sent back to the manufacturer for re-calibration or replacement.

A leak check of the PM-10 sampling train will be conducted at the beginning and conclusion of each sampling run. Sample flow rate of the PM-10 instrument will be calibrated in accordance with the manufacturers instructions. A variation of ± 20 percent in the velocity head readings necessitate additional adjustments in flow rate. Operation and QA of the PM-10 instrument will be in accordance with EPA Method 5 - Determination of Particulate Matter Emissions From Stationary Sources (Appendix B).

During calibration, a closure plate perforated with a number of circular orifices is connected to the inlet of the sampler. The pressure drop across this orifice plate provides a measure of instrument air flow rate at any time. This pressure drop may be indicated by a rotameter, manometer, or other pressure-responsive device traceable to an NIST certified standard (EPA, 1999). All sampler filters must be visually inspected for defects, and defective filters must be

rejected if any are found. Batches of filters containing numerous defects will be returned to the supplier. Specific defects to look for are pinholes, loose material, non-uniformity or symmetry, or discoloration.

2.5.2 Sample Collection - Air

Sampling and monitoring will be conducted according to the Nevada Ambient Air Quality Monitoring Guidelines issued by the NDEP/Bureau of Air Quality and published EPA guidance and procedures for State and Local Air Monitoring Stations (SLAMS).

Collection and analysis methods may be either manual or automated (analyzers). For SO₂, particulates, and lead, the reference method for each is a unique manual method that is completely specified in 40 CFR Part 50 (Appendices A, B, and G respectively) (EPA, 1998c). Revised requirements for ambient air quality reference methods for particulate air sampling are provided in 40 CFR Parts 53 and 58. Installation of air sampling devices and equipment is covered in Section 6.3.

The following information will be obtained from all air sampling activities:

- Sampler identification
- Run date and time
- Type of sampler and model
- Elapsed run time (minutes)
- Actual flow rate (m³/min)
- Standard flow rate (m³/min)
- Calibration methods
- Minimum detection limit
- Maximum detection limit
- Filter serial number
- Gross filter weight (g)
- Tare filter weight (g)
- Net weight (g)
- Particulate concentration (ug/m³)

The reference method for PM₁₀ sampling will follow NDEP guidance. Additional guidance is given in 40 CFR Part 50, Appendix J and implemented in the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II," Section 2.11 and in the "Quality Assurance Guidance Document 2.11, Monitoring PM₁₀ in Ambient Air Using a High-Volume Sampler Method". The following procedure is recommended by NDEP and EPA (1999) for air sampling using a PM₁₀ high-volume air sampler, to be modified for the mid volume samplers to be used at the Yerington Mine Site:

1. Perform a laboratory check to determine if the sampler is operational. Turn on the sampler and observe the vacuum motor performance and shift the recorder response (if so equipped).
2. Carefully transport the sampler to the field site. Following manufacturer's instructions, carefully assemble the base and inlet of the sampler. The sampler must be bolted down to a secure mounting surface. Refer to Section 6.3 of this QAPP for specific sampler installation procedures.
3. Check all tubing and power cords for crimps, cracks, or breaks.
4. Plug the power cord into a line voltage outlet. The use of waterproof interlocking electrical connectors is recommended to ensure operator safety and to avoid shorts or power interruptions.
5. Turn on the sampler and make sure that it is still working properly. Investigate and correct any malfunctions before proceeding. Operate the sampler for approximately 30 min to ensure that the motor brushes are properly seated and that the motor is operating at full performance.
6. Perform a multipoint flow-rate calibration, as described in the instrument calibration manual. Do not make any change or adjustment on the sampler flow indicator after calibrating.
7. Remove the calibrating orifice. Mount the filter sheet in the filter holder taking care not to lose any of the fiber. Clamp it in place by means provided. Seal into place easier by facing the smooth side into the housing if there is a difference in texture. If the filter holder is separate from the sampler, mount the holder on the intake port, making sure that the coupling gasket is in place and that it is tight.
8. Place the sampler in the position and location called for in the test, which is with the filter face up, in a horizontal plane, and inside a housing. The dimensions and clearances specified are intended to provide uniformity in sampling practice.
9. Start the sampler motor and record the time and date. Note the temperature and barometric pressure. Read the flow-rate indicator and record this reading and the corresponding flow rate as read from the calibration curve. An electric clock will be

- connected to the same line as the motor so as to detect any loss of test time due to power interruption. A continuous record of the sampling flow rate and sampling time can be obtained by the use of a continuous pressure (or flow rate) recorder.
10. Allow the sample to run for the specified length of time, which is commonly 24 h, ± 1 h. During this period several readings of flow rate, temperatures, barometric pressure, and time will be taken if this is feasible. A final set of reading is taken at the end of the test period. If only initial and final readings are made, assume that change of readings is linear over the period of test. Intermediate readings will improve the accuracy of volume measurement.
 11. At the end of the sampling period, record all final readings. Remove the filter from the mount very carefully so as not to lose any of the fiber material or collected particulate matter. Fold the filter in half upon itself with the collected material enclosed within. Place the folded filter in a clean tight envelope or metal container and mark it for identification.

PM₁₀ filters will be weighed prior to and after sampling and after they have been allowed to equilibrate to temperature (between 15 and 30 °C) and humidity (20 to 45 percent) for 24 hours. An NDEP certified laboratory will perform the chemical analyses of the particulate matter collected on the filters on a quarterly basis. Particulate matter will be analyzed for metals using the X-Ray Fluorescence (XRF) Air Filter Analysis with the exception of beryllium, which must be analyzed using atomic absorption analysis. Teflon filters will be used to facilitate XRF spectroscopy for metals analysis.

The accuracy of mid-volume PM₁₀ samplers is assessed by auditing the flow rate of each sampler with an orifice transfer standard. Then the corrected sampler flow rate without an orifice transfer standard is compared to the design flow rate. Refer to the manufacturers' operation manual for calibration methods specific to each PM₁₀ sampler.

Sampling Periods and Frequency

Sampling will conform with the sixth-day particulate sampling schedule consistent with NDEP guidelines. Each sampler will be operated for 24 hours at least every designated sixth day throughout the year. For continuous ambient air quality monitoring data, at least 45 minutes of valid observations are required to represent an hourly average. Running averages of more than one hour will require valid observations for at least 75 percent of the hours in the averaging period.

Particulate Concentration

Mid-volume PM₁₀ sampling calculations will conform to the "Quality Assurance Guidance Document 2.11, Monitoring PM₁₀ in Ambient Air Using a High-Volume Sampler Method" or Section 2.11 of the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods (Interim Edition)." The concentration of PM₁₀ in the ambient air is computed as the total mass of the collected particles divided by the volume of air sampled.

The measured concentrations from all samplers will be reported including, as applicable, the percentage difference in concentrations between any two or more co-located samplers for concentrations above 80 µg/m³.

The current 24-hour PM₁₀ standard has been revised, based on the 3-year average of the 99th percentile of 24-hour PM₁₀ concentrations at each sampling location. The current annual PM₁₀ standard of 50 µg/m³ is met when the 3-year average of the annual arithmetic mean PM₁₀ concentrations at each monitor within an area is less than or equal to 50 µg/m³, with fractional parts of 0.5 or greater rounding up (NDEP 2000).

2.5.3 Sample Identification and Preservation - Air

All collected samples must be carefully removed from the monitoring device and placed in sealed, nonreactive containers. If the container is for air sample filters, it will be sealed by placing a piece of tape or a sticker over the top and bottom to avoid accidental opening of the container. The tape or sticker should act as a custody seal, and be labeled with the date, time, and initials of the field personnel. This sticker must adhere firmly to ensure that it cannot be removed without destruction. If the air sample container is a closed plastic bag of the sampled air itself, the same procedure will be followed, using an adhesive custody seal over the bag closure.

Sample labels will be completed and attached to each laboratory sample container prior to collection of the sample. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Analyses to be performed
- Sample type
- Person who collected sample

Each sample will be tracked according to a unique sample field identification number assigned when the sample will be collected. This field identification number consists of three parts:

- Sampling event sequence number
- Sampling location
- Collection sequence number

For example, a hypothetical sample collected along the west edge of the Sulfide Tailings during the third sampling event at the fourth location sampled would be labeled: 003STW004. Blanks and duplicate samples will be labeled in the same fashion, with no indication of their contents (Section 2.6).

Sealed containers with air sample filters or bags of air will be placed inside an ice chest, with no ice. The presence of ice would cool the bags, allowing potential condensation, or may allow moisture to enter the filter containers, both undesirable occurrences. Sealed plastic bags of sampled air will be filled to less than full capacity to allow for expansion and contraction of the air and bag in case the samples are transported to a different elevation. This procedure will avoid potential bursting of the bag.

2.5.4 Decontamination Procedures - Air

All air sampling equipment will be cleaned between sampling events. Parts of mid-volume air samplers that have been exposed to sampled air flow will be cleaned in accordance with the manufacturers' instructions. Tubing on personal air samplers will be replaced with new tubing. Fresh air will be allowed to run through probes and meters in accordance with the manufacturers'

instructions, and for a period of not less than two minutes.

2.6 Duplicate Samples and Blanks - All Sampling

The following sub-sections describe duplicate samples, rinsate blanks, and field and trip blanks that are prepared for the purpose of quality assurance.

2.6.1 Duplicate Samples

Duplicate samples will be collected at a frequency of one per every 10 samples for each analysis. Duplicate samples will be collected by filling the containers for each analysis at the same time the original sample is collected. Duplicate samples will be collected in exactly the same manner as regular samples. For quality assurance purposes, duplicate samples will be labeled in the same fashion as regular samples, with no indication that they are QC samples. Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent “blind” to the lab.

Each sample from a duplicate set will have a unique sample number labeled in accordance with the identification protocol, and the duplicates will be sent “blind” to the lab. For example, a duplicate sample to 003NEP004 might be labeled 003NEP006, with documentation in the field notebook that 003NEP004 and 003NEP006 are duplicate samples.

Volatile Constituents in Soil

Samples with a duplicate collected for analysis of volatiles (e.g., VOCs, petroleum or solvents) will be collected with a dedicated collection/storage device for each “twin” sample. Where a dedicated collection/storage device cannot be used, samples collected with a coring tool or trowel will be removed from the coring tool (e.g., split-spoon, boring auger, or probe casing) or trowel and divided in half vertically over the interval to be collected for analysis. The resulting “twin” samples shall be transferred to containers in accordance with Section 2.1.3 for VOCs. All effort shall be made to minimize disturbance to the intact sample. These methods are employed to minimize volatilization of volatile constituents.

Non-volatile Constituents in Soil

Samples collected for analysis of non-volatiles (e.g., metals) from either excavations or point sample locations will be collected in the same manner as previously described, then thoroughly mixed in a shallow plastic or metallic mixing tray with the trowel or hand shovel and transferred from the tray to separate sample containers.

2.6.2 Equipment Rinsate Blanks

In general, equipment rinsate blanks will be collected when reusable, non-disposable sampling equipment (e.g., water level probe) are being used for the sampling event. A minimum of one equipment rinsate blank is prepared each day when equipment is decontaminated in the field.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring laboratory-grade, certified organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix (e.g., soil, groundwater, etc.) each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for the same analytes as normal samples. The equipment rinsate blanks will be preserved, packaged, and sealed in the same manner as for groundwater, described in Section 2.3.4 and Table 2-3. A separate identification sample number will be assigned to each rinsate blank, and it will be submitted blind to the laboratory.

2.6.3 Field and Trip Blanks

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling procedures. For groundwater or surface water samples, field blanks will be created by pouring laboratory-grade de-ionized or certified organic-free water into a sampling container at one of the sampling points. For soil or sediment samples, field blanks will be created by transferring a known source of uncontaminated solid (e.g., commercial sterilized soil) into a sampling container at one of the sampling points. Field blanks will be collected at a frequency of one per every 20 samples, with a minimum of one blank for less than 20 samples.

The exact same collection procedures will be used for preparation of field blanks as was used for regular sampling. The field blanks that are prepared will be analyzed for the same analytes as regular samples. The field blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each blank, and it will be submitted blind to the laboratory.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the sample stream and if cross contamination in the form of migration has occurred among the collected samples. Groundwater and surface water trip blanks will be prepared by pouring distilled or de-ionized solvent free water into 40 milliliter (ml) vials prior to arriving at the site, sealing the vials and then transporting them to the site. Soil and sediment trip blanks will be prepared by transferring a known source of clean, uncontaminated solid into a four-ounce jar, and sealing the lid.

The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same insulated chest with the regular samples collected for analyses. The trip blanks will be preserved, packaged, and sealed in the manner described in the appropriate section for the type of medium being prepared. A separate identification sample number will be assigned to each trip blank and it will be submitted blind to the laboratory. Trip blanks will be collected at a frequency of one per sampling event per type of matrix, whether that event occurs over one day or several days.

2.7 Training and Certification - Field Methods and Procedures

Appropriate education and training are integral to any sampling or monitoring program that seeks to obtain reliable data. Personnel assigned to field sampling or monitoring activities are expected to have met the educational, work experience, and training requirements for the particular type of sampling or monitoring. In some cases, field activities require specific certification. Records on personnel qualifications and training will be maintained and will be accessible for review during all activities.

In general, training and certification for air, water, and soil monitoring and sampling is not

required in the State of Nevada. However, Phase I Environmental Site Assessments and Underground Storage Tank closure and assessment work in the state of Nevada requires oversight by a Nevada Certified Environmental Manager.

Health and Safety Training

Subcontractor personnel working on any Atlantic Richfield mine site or associated site or facility must have successfully completed training appropriate for the working conditions. This may include some combination of:

- Hazardous waste site operations in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements specified in 29 CFR 1910.120(e) and 8 CCR 5192(e); and
- Mine operations safety in accordance with the Mine Safety and Health Administration (MSHA) Mine Act, Sections 115 and 302.

Specific Health and safety training is beyond the scope of this QAPP, and is covered in the Site Health and Safety Plan and in Job Safety Analyses specific for each Work Plan.

2.8 Summary of Sample Collection and Storage Parameters

For each type of media sampled, there are specific containers, preservatives, and storage conditions that are required. The following tables summarize the necessary containers, amount needed for analysis, maximum hold time, filtering and preservatives, and storage temperature.

Table 2-3. Summary of Sample Collection and Storage Parameters – Soil and Sediment

Parameter	Amount for Analysis	Minimum filled cont. size	Filtering	Maximum Hold Time	Storage temperature	Preservatives
Volatile Organic Compounds	30 grams minimum	(4) VOA vials	None	14 days	4°C	Methanol or sodium bisulfate
		(3) collection/ storage devices or (4) VOA vials	None	48 hours	4°C	None
Semi-volatile Organic Compounds	30 grams minimum	(3) collection/ storage devices or (4) VOA vials	None	14 days	4°C	None
Total Petroleum Hydrocarbons – (DRO)	0.65 kg or 8 ounces	8-ounce glass jar	None	14 days	4°C	None
Total Petroleum Hydrocarbons – (GRO)	0.65 kg or 8 ounces	8-ounce glass jar	None	48 hours	4°C	None
	5 grams minimum	(4) VOA vials	None	14 days	4°C	Methanol or sodium bisulfate
Acid-Base Accounting	2. kg or 0.5 gallon	1-gallon plastic	None	N.A.	4°C	None
NPK, Sodium Absorption ratio	1. kg or 0.25 gal.	1-gallon plastic	None	N.A.	4°C	None
Metals	Varies per metal	8-ounce glass jar	None	6 months*	4°C	None
Whole Rock Analysis	2. kg or 0.5 gallon	1-gallon plastic	None	6 months*	4°C	None
Meteoric Water Mobility	5 gallon	5-gallon plastic	None	None	4°C	None
Chlorinated Herbicides	8 ounces	8-ounce glass jar	None	14 days	4°C	None
Organo-Pesticides and PCB	8 ounces	8-ounce glass jar	None	14 days	4°C	None

* Solid: Mercury=28 days; Chromium VI=1 month

NPK= Nitrogen, Phosphorous, and Potassium

N.A. = Not Applicable

Table 2-4. Summary of Sample Collection and Storage Parameters – Groundwater and Surface Water

Parameter	Amount for Analysis	Minimum filled cont. size	Filtering	Maximum Hold Time	Storage temperature	Preservatives
Dissolved Metals	Varies per metal	500 mL HDPE	0.45 µm	6 months*	4°C	HNO ₃ to pH<2 [#]
Anions-general	Varies per anion	250 mL HDPE	None	Varies per anion	4°C	None
Acidity/ Alkalinity	100/200 mL	500 mL HDPE	None	14 days	4°C	None
Volatile Organic Compounds (including Total Petroleum Hyd.)	5 mL	(3) 40-mL glass vials	None	14 days	4°C	HCl to pH<2
Semi-volatile Organic Compounds	1,000 mL	(2) 1-liter amber glass	None	14 days	4°C	None
Total Dissolved Solids; Total Solids; Total Suspended Solids	1,000 mL	1,000 mL HDPE	None	7 days	4°C	None
Sulfate, Chloride, Bromide, Fluoride	500 mL	1,000 mL HDPE	None	28 days	4°C	None
Total Organic Carbon	100 mL	250 mL HDPE	None	28 days	4°C	HCl to pH<2
Phosphorous	100 mL	250 mL HDPE	None	48 hours	4°C	H ₂ SO ₄ to pH<2
Nitrate	100 mL	250 mL HDPE	None	48 hours	4°C	None
				7 days	4°C	H ₂ SO ₄ to pH<2
Total Metals	Varies per metal	500 mL HDPE	None	6 months*	4°C	HNO ₃ to pH<2 [#]

*Aqueous: Mercury= 28 days; Chromium VI= 24 hours

HDPE= High-density polyethylene

HNO₃= Nitric acid

No acidification for Chromium VI

HCl = Hydrochloric Acid

H₂SO₄ = Sulfuric Acid**Table 2-5. Summary of Sample Collection and Storage Parameters -- Air**

Parameter	Amount for Analysis	Minimum filled cont. size	Filtering	Maximum Hold Time	Storage temperature	Preservatives
Particulate Matter (PM)	Filter	Solid plastic	None	7 days	Ambient temp.	None
Gas	1 liter	Tevlar bag	None	2 days**	Ambient temp.	None

** Sulfur compounds =24 hours

SECTION 3.0

LABORATORY METHODS AND PROCEDURES

The choice of analytical methods will be influenced by performance criteria, Data Quality Objectives, and regulatory criteria. Once the decision has been made on methods and detection limits to be employed and analyses are underway, the laboratory monitors the precision and accuracy of the results of their analytical procedures through analysis of QC samples. Internal laboratory QC consist of matrix spike analyses, blanks, and matrix spike duplicate analyses. Field QC consist of rinsate blanks, field and trip blanks, and duplicate samples. The laboratory will analyze both internal and field QC preparations.

Prior to acceptance of an analytical laboratory to analyze samples, the laboratory must submit to Atlantic Richfield a comprehensive QC document outlining all methods, types of QC analyses and standards, and acceptance criteria for internal QC, as described in Section 3.6. Upon request from regulatory agencies, the laboratory QC document will be provided. After acceptance, this comprehensive QC document will be added to the QAPP as an appendix. In addition to the QA/QC tables within Section 3, available EPA Region 9 data quality indicator tables have been attached to this QAPP as Appendix C as a supplemental reference for assisting in review of laboratory analytical methods.

3.1 Soil and Sediment Analysis

Collected soil and sediment samples will be analyzed by a Nevada-licensed laboratory. Soil and sediment analyses methods and detection limits are listed in Table 3-1, Section 3.7. Depending on the nature of activities associated with a particular mine unit or area, or previous investigation results, soil or sediment samples would be submitted for laboratory analysis of some combination of:

- Total petroleum hydrocarbons (TPH)
- Volatile Organic Compounds (VOC)
- Semi-volatile Organic Compounds (SVOC)

- Dissolved and/or total metals
- pH
- Acid-base accounting (ABA)
- Net Acid Generation (NAG) potential
- Meteoric Water Mobility Procedure (MWMP) Profile I
- Agricultural chemistry
- Polychlorinatedbiphenyls (PCB)
- Organic-pesticides (OP)
- Chlorinated herbicides (CH)

Samples specified for agricultural chemistry evaluation will be submitted to a laboratory experienced in the evaluation of soils for use as a growth medium. The samples will be tested for at least the following values:

- Nitrogen, Phosphorus, and Potassium (NPK)
- Boron and Chlorine
- Calcium, Magnesium and Sodium
- Sodium Absorption Ratio (SAR)

Table 2-3, Section 2.8 provides the soil sample minimum collection quantities that are required for laboratory analysis.

3.2 Ground and Surface Water Analysis

Laboratory methods and detection limits for analyses of groundwater and surface water samples will be conducted in accordance with Tables 3-2 and 3-3, respectively. Groundwater and surface water samples will be analyzed for some combination of the following, depending on the nature of activities associated with a particular mine unit or area, documentation of spills or releases in that area, regulatory requests, or previous investigation results:

- Dissolved and/or total metals
- Volatile Organic Compounds (including TPH)

- Semi-volatile Organic Compounds
- Sulfate
- Nitrate
- Chloride
- Acidity
- Alkalinity
- Hardness
- Total dissolved solids

An NDEP-certified laboratory will perform all laboratory analyses.

3.3 Air Analysis

Laboratory methods and detection limits for analyses of air samples will be conducted in accordance with Table 3-4, Section 3.7. Meteorological data that is either collected from on-site stations or from off-site stations may be combined with air sampling results to assess the impact to air quality downwind of certain sources. Air samples will be analyzed for some combination of the following, depending on the nature of activities associated with a particular mine unit or area, documentation of airborne dust in that area, regulatory requests, or previous investigation results:

- Metals
- Particulate Matter (PM₁₀)

PM₁₀ filters will be weighed prior to and after sampling, after they have been allowed to equilibrate to temperature (between 15 and 30 °C) and humidity (20 to 45 percent) for 24 hours. An EPA-certified laboratory will perform the chemical analyses of the particulate matter collected on the filters on a quarterly basis. Particulate matter will be analyzed for metals using the X-Ray Fluorescence (XRF) Air Filter Analysis with the exception of beryllium, which must be analyzed using atomic absorption analysis.

3.4 Data Package and Reporting Format

The general reporting format for laboratory data packages submitted for data validation may consist of the following sections:

- Case narrative;
- Chain-of-Custody documentation;
- Summary of results for environmental samples (including quantitation limits);
- Summary of QA/QC results; and
- Raw data.

As requested, the laboratory will make available for inclusion in their data package the following information:

- Standard Operating Procedures (SOPs)
- Standard Methods used
- Calibration standards and concentrations used
- Description of matrix blanks, replicates, and other QA/QC procedures
- Description of adaptations or modifications of a “standard” method
- References to procedures in other text

3.5 Laboratory QA Requirements - All Analyses

Laboratory sample preparation procedures will be described and standard methods cited and used. The sampling containers, condition of samples received, sample temperature, holding times, holding conditions, number and types of all QA/QC samples to be prepared and analyzed, percent recovery, and name of the laboratory that is performing the analyses need to be specifically referenced.

SOPs provided by each laboratory will be double-checked by Atlantic Richfield to ensure they: are consistent with organizational practices; can serve as training aids; provide ready reference and documentation of proper procedures; reduce work effort; reduce error occurrences in data; and improve data comparability, credibility, and defensibility. The SOPs will be sufficiently

clear and written in a step-by-step format to be readily understood by a person knowledgeable in the general concept of the procedure. SOPs should follow the guidance document Guidance for the Preparation of Standard Operating Procedures EPA QA/G-6. Copies of this document are available through the QAD office as well as the QAD Homepage (<http://es.epa.gov/ncerqa>).

3.6 QC Requirements - All Analyses

Laboratories will analyze all submitted field QC duplicates and blanks. Proper documentation of sample preparation and condition of QC samples received must be conducted, as described in Section 3.5. For rinsate blank preparation, refer to Section 2.6. A minimum of one rinsate blank is prepared each day when equipment is decontaminated in the field. Field blank and trip blank preparation is also covered in Section 2.6. A minimum of one field blank is prepared for every 20 samples. A trip blank is required for each sampling event. These blanks are submitted "blind" to the laboratory, packaged like other samples and each with its own unique identification number. In addition to field QC, laboratories will prepare and analyze internal QC spikes and blanks according to the laboratory's typical QC schedule.

Prior to acceptance of an analytical laboratory to analyze samples, the laboratory must submit to Atlantic Richfield a comprehensive QC document outlining acceptance criteria for internal QC. This internal QC document must address (but is not limited to): matrix spikes, duplicates, blanks, initial and second source calibrations, and other laboratory control samples. The document must describe acceptance criteria for (but is not limited to): percent recovery, error, accuracy, and precision. Atlantic Richfield will review the submitted laboratory QC document and provide comments for revision, if necessary. Upon request, a copy of the laboratory QC document shall also be provided to the regulatory agencies for review. After acceptance, this comprehensive QC document will be added to the QAPP as an appendix.

3.7 Methods and Detection Limits - All Analysis

Analysis methods and detection limits for the various matrices are provided in the following tables:

- Table 3-1 Laboratory Methods and Detection Limits for Soil and Sediment Analyses
- Table 3-2 Laboratory Methods and Detection Limits for Groundwater Analyses
- Table 3-3 Laboratory Methods and Detection Limits for Surface Water Analyses
- Table 3-4 Laboratory Methods and Detection Limits for Air Analyses
- Table 3-5 Comparison of Laboratory Method Detection Limits to Analytical Trigger Levels – Soil and Sediment

Detection limits shown in Tables 3-1 through 3-5 are equal to or less than the detection limits specified in EPA Data Quality Indicator (DQI) Tables or the listed EPA Methods (Appendix C). Detection limits provided for soils and sediment in Table 3-1 are compared to analytical trigger levels in Table 3-5, reproduced from the Draft Final Process Areas Work Plan.

Table 3-1. Laboratory Methods and Detection Limits for Soil and Sediment Analyses				
Parameter or Analyte	Phase	Method	Detection Limit	Units
Aluminum – ICP-OES	Solid	EPA 200.7	0.05	mg/Kg
Antimony – ICP-MS	Solid	EPA 200.8	1	mg/Kg
Arsenic – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Barium – ICP-MS	Solid	EPA 200.8	1	mg/Kg
Beryllium – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Boron – ICP-OES	Solid	EPA 200.7	0.05	mg/Kg
Cadmium – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Calcium – ICP-OES	Solid	EPA 200.7	0.1	mg/Kg
Chromium – ICP-MS	Solid	EPA 200.8	1	mg/Kg
Cobalt – ICP-MS	Solid	EPA 200.8	0.25	mg/Kg
Copper – ICP-MS	Solid	EPA 200.8	1	mg/Kg
Iron – ICP-OES	Solid	EPA 200.7	0.05	mg/Kg
Lead – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Magnesium – ICP-OES	Solid	EPA 200.7	0.1	mg/Kg
Manganese – ICP-MS	Solid	EPA 200.8	0.25	mg/Kg
Mercury – AA Cold Vapor	Solid	EPA 200.7	0.05	mg/Kg
Molybdenum ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Nickel – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Potassium – ICP-OES	Solid	EPA 200.7	0.5	mg/Kg
Selenium – ICP-MS	Solid	EPA 200.8	0.1	mg/Kg
Silver – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Sodium – ICP-OES	Solid	EPA 200.7	0.1	mg/Kg
Thallium – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Vanadium – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg
Zinc – ICP-MS	Solid	EPA 200.8	0.5	mg/Kg

Table 3-1. Laboratory Methods and Detection Limits for Soil and Sediment Analyses -- Continued

Parameter or Analyte	Phase	Method	Detection Limit	Units
Agricultural Nitrogen/Phosphorous/ Potassium (NPK)	Solid	EPA 300.0, 200.7;	0.1/0.1/0.5	mg/Kg
Calcium/Magnesium/ Sodium		EPA 200.7	0.1/0.1/0.1	
Sodium Absorption Ratio		EPA 9081	N.A.	
Boron/Chlorine		EPA 300.0	0.05/1.0	
Total Petroleum Hydrocarbons	Solid	EPA 8015B EPA 8020A	10	mg/Kg
Total Recoverable Metals – Acid Digestion	Solid	EPA 3050A	--	--
Volatile Organic Compounds	Solid	EPA 8260B EPA 5035A	Varies depending on compound*	mg/Kg
Semi-volatile Organic Compounds	Solid	EPA 8270D	Varies depending on compound*	mg/Kg
Chlorinated Herbicides	Solid	EPA 8151	0.033 17 (MCPD) 17 (MCPA)	mg/Kg
Organo-Pesticides and PCB	Solid	EPA 8080 or 8081 EPA 8141A	Varies depending on compound*	mg/Kg

* Refer to DQI Tables and Methods (Appendix C)

Table 3-2. Laboratory Methods and Detection Limits for Groundwater Analyses

Parameter or Analyte	Phase	Method	Detection Limit	Units
Alkalinity Total	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Bicarbonate	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Carbonate	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Hydroxide	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Aluminum – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Antimony – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Arsenic – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Barium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Beryllium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Boron – ICP-OES	Total & Dissolved	EPA 200.7	0.01	mg/l
Cadmium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Calcium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Chloride – Ion Chromatography	Total	EPA 300.0	0.5	mg/l
Chromium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Cobalt – ICP-MS	Total & Dissolved	EPA 200.8	0.0005	mg/l
Copper – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Fluoride - Ion Chromatography	Total	EPA 300.0	0.1	mg/l
Iron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Lead – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Magnesium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Manganese – ICP-MS	Total & Dissolved	EPA 200.8	0.0005	mg/l
Mercury – AA Cold Vapor	Total & Dissolved	EPA 245.1	0.0002	mg/l
Molybdenum -ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nickel – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Potassium – ICP-OES	Total & Dissolved	EPA 200.7	0.5	mg/l
Selenium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Silver – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sodium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Thallium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Vanadium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Zinc – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sulfate – Ion Chromatography	Total	EPA 300.0	0.2	mg/l
Nitrate – N- Ion Chromatography	Total	EPA 300.0	0.05	mg/l N
Hardness, as CaCO ₃	Total	EPA 130.2 (SM 2340 C)	0.1	mg/l (as CaCO ₃)
pH	Total	EPA 150.1 (SM 4500 H+B)	1 to 14	pH Units
pH - Temperature	Total	EPA 150.1 (SM 4500 H+B)	0.1	°C
Suspended Solids	Total	EPA 160.2 (SM 2540 D)	4	mg/l
Total Dissolved Solids	Total	EPA 160.1 (SM 2540 C)	10	mg/l
Total Petroleum Hydrocarbons	Total	EPA 8015B	0.1	mg/l
Turbidity	Total	EPA 180.1 (SM 2130 B)	0.05 to 5 depending on NTUs	NTU
Volatile Organic Compounds	Total	EPA 8260B	0.001	mg/l

Table 3-3. Laboratory Methods and Detection Limits for Surface Water Analyses

Parameter or Analyte	Phase	Method	Detection Limit	Units
Alkalinity Total	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Bicarbonate	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Carbonate	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Alkalinity/Hydroxide	Total	SM 2320 B	1.0	mg/l (as CaCO ₃)
Aluminum – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Antimony – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Arsenic – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Barium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Beryllium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Boron – ICP-OES	Total & Dissolved	EPA 200.7	0.01	mg/l
Cadmium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Calcium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Chloride – Ion Chromatography	Total	EPA 300.0	0.5	mg/l
Chromium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Cobalt – ICP-MS	Total & Dissolved	EPA 200.8	0.0005	mg/l
Copper – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Fluoride - Ion Chromatography	Total	EPA 300.0	0.1	mg/l
Iron – ICP-OES	Total & Dissolved	EPA 200.7	0.05	mg/l
Lead – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Magnesium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Manganese – ICP-MS	Total & Dissolved	EPA 200.8	0.0005	mg/l
Mercury – AA Cold Vapor	Total & Dissolved	EPA 245.1	0.0002	mg/l
Molybdenum -ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Nickel – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Potassium – ICP-OES	Total & Dissolved	EPA 200.7	0.5	mg/l
Selenium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Silver – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sodium – ICP-OES	Total & Dissolved	EPA 200.7	0.1	mg/l
Thallium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Vanadium – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Zinc – ICP-MS	Total & Dissolved	EPA 200.8	0.001	mg/l
Sulfate – Ion Chromatography	Total	EPA 300.0	0.2	mg/l
Nitrate – N- Ion Chromatography	Total	EPA 300.0	0.05	mg/l N
Hardness, as CaCO ₃	Total	EPA 130.2 (SM 2340 C)	0.1	mg/l (as CaCO ₃)
pH	Total	EPA 150.1 (SM 4500 H+B)	1 to 14	pH Units
pH - Temperature	Total	EPA 150.1 (SM 4500 H+B)	0.1	°C
Suspended Solids	Total	EPA 160.2 (SM 2540 D)	4	mg/l
Total Dissolved Solids	Total	EPA 160.1 (SM 2540 C)	10	mg/l
Total Petroleum Hydrocarbons	Total	EPA 8015B	0.1	mg/l
Turbidity	Total	EPA 180.1 (SM 2130 B)	0.05 to 5 depending on NTUs	NTU
Volatile Organic Compounds	Total	EPA 8260B	0.001	mg/l

Table 3-4. Laboratory Methods and Detection Limits for Air Analyses

Parameter or Analyte	Phase	Method	Detection Limit	Units
Total Petroleum Hydrocarbons	Air	T0-3	0.025	ppm-v
Particulate	Air/Solid	I02.3	1.0	mg
Aluminum	Air/Solid	(XRF) I03.3	*	mg/kg
Antimony	Air/Solid	(XRF) I03.3	*	mg/kg
Arsenic	Air/Solid	(XRF) I03.3	*	mg/kg
Barium	Air/Solid	(XRF) I03.3	*	mg/kg
Beryllium	Air/Solid	Atomic Adsorption Spectroscopy	8	ng/cm ²
Boron	Air/Solid	Atomic Adsorption Spectroscopy	*	ng/cm ²
Cadmium	Air/Solid	(XRF) I03.3	*	mg/kg
Calcium	Air/Solid	(XRF) I03.3	*	mg/kg
Chromium	Air/Solid	(XRF) I03.3	*	mg/kg
Cobalt	Air/Solid	(XRF) I03.3	*	mg/kg
Copper	Air/Solid	(XRF) I03.3	*	mg/kg
Iron	Air/Solid	(XRF) I03.3	*	mg/kg
Lead	Air/Solid	(XRF) I03.3	*	mg/kg
Magnesium	Air/Solid	(XRF) I03.3	*	mg/kg
Manganese	Air/Solid	(XRF) I03.3	*	mg/kg
Mercury	Air/Solid	(XRF) I03.3	*	mg/kg
Molybdenum	Air/Solid	(XRF) I03.3	*	mg/kg
Nickel	Air/Solid	(XRF) I03.3	*	mg/kg
Potassium	Air/Solid	(XRF) I03.3	*	mg/kg
Selenium	Air/Solid	(XRF) I03.3	*	mg/kg
Silver	Air/Solid	(XRF) I03.3	*	mg/kg
Sodium	Air/Solid	Atomic Adsorption Spectroscopy	*	ng/cm ²
Thallium	Air/Solid	(XRF) I03.3	*	mg/kg
Total Recoverable Metals	Air/Solid	(XRF) I03.3	*	mg/kg
Vanadium	Air/Solid	(XRF) I03.3	*	mg/kg
Zinc	Air/Solid	(XRF) I03.3	*	mg/kg
PM ₁₀	Air/Solid	IO 2.0 and IO 2.1; PM10	10	µm

ppm-v=parts per million by volume

*detection limits for metals vary depending on element, air sampling flowrate, and area of deposit.

XRF = x-ray fluorescence

Table 3-5. Comparison of Laboratory Method Detection Limits to Analytical Trigger Levels – Soil and Sediment			
Parameter Analyte	Region 9 Industrial PRGs (values in mg/kg)	Method Detection Limit (mg/Kg)	Method
Aluminum	100,000	0.05	EPA 200.7
Antimony	410	1	EPA 200.8
Arsenic (a)	16 – 100	0.5	EPA 200.8
Barium	67,000	1	EPA 200.8
Beryllium	1,900	0.5	EPA 200.8
Boron	100,000	0.05	EPA 200.7
Cadmium	450	0.5	EPA 200.8
Calcium	not available	0.1	EPA 200.7
Chromium (b)	450	1	EPA 200.8
Cobalt	1,900	0.25	EPA 200.8
Copper	41,000	1	EPA 200.8
Iron	100,000	0.05	EPA 200.7
Lead	750	0.5	EPA 200.8
Magnesium	not available	0.1	EPA 200.7
Manganese	19,000	0.25	EPA 200.8
Mercury	310	0.05	EPA 200.7
Molybdenum	5,100	0.5	EPA 200.8
Nickel	20,000	0.5	EPA 200.8
Potassium	not available	0.5	EPA 200.7
Selenium	5,100	0.1	EPA 200.8
Silver	5,100	0.5	EPA 200.8
Sodium	not available	0.1	EPA 200.7
Thallium	67	0.5	EPA 200.8
Vanadium	7,200	0.5	EPA 200.8
Zinc	100,000	0.5	EPA 200.8
Chlorinated Herbicides		0.033; 17 (MCPP); 17 (MCPA)	EPA 8151
Organo-Pesticides and PCB		Varies depending on compound	EPA 8080 or 8081; EPA 8141A

(a) Method detection limit is less than background concentrations (ref: Sheckletter, H.T. and Boerger, J.G., 1984, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", U.S. Geological Survey Professional Paper 1270; and Rose, A.W., Hawkes, H.E. and Webb, J.S., 1979 "Geochemistry in Mineral Exploration", Academic Press, New York, NY, 657 p).

(b) Total Chromium (1: 6 ratio Cr VI: Cr III)

SECTION 4.0

HANDLING, DOCUMENTATION AND TRANSPORT

The following sections describe the preparation of samples in the field for transport to the laboratory, including handling, labeling, packaging, documentation, shipment preparation, and custodial quality control.

4.1 Sample Handling and Transport - All Samples

The QA objectives for the sample-handling portion of the field activities are to verify that decontamination, packaging, and shipping are not introducing variables into the sampling chain that could render the validity of the samples questionable. In order to fulfill these QA objectives, duplicate samples, rinsate blanks, and field and trip blanks (Section 2.6) will be used. If the analysis of any QA sample indicates that variables are being introduced into the sampling chain, then the samples shipped with the questionable QA sample will be evaluated for the possibility of cross-contamination and whether handling and transport procedures were involved.

The following sample packaging and shipment procedures will be followed for the samples to ensure that they are intact when they arrive at the designated laboratory:

- Place a custody seal over each container.
- Wrap all glass sample containers in bubble wrap to prevent breakage.
- Place each container in a zip-loc plastic bag and seal the plastic bag shut.
- Place the sealed containers in the appropriate ice chest.
- Empty space in the cooler will be filled with bubble wrap or styrofoam to prevent movement and breakage during shipment.
- Contained ice will be double zip-loc bagged (except for air samples).
- If shipping the ice chest, enclose the chain of custody form and other sample paperwork in the ice chest by placing it in a plastic bag and taping the bag to the inside of the ice chest lid.
- Seal the ice chest shut with strapping tape and place two custody seals on the front of the cooler so that the custody seals extend from the lid to the main body of the ice chest. Place clear tape over each custody seal on the outside of the ice chest.

- When ice is used, secure the drain plug of the ice chest with fiberglass tape to prevent melting ice from leaking out of the ice chest.
- Label ice chest with “Fragile” and “This End Up” labels.
- Place the shipper label on each cooler with the laboratory address and the return address, and other pertinent information.
- Transport ice chests to the appropriate laboratory within 24 hours by hand-delivery or via express overnight delivery.
- Coordinate deliveries with the laboratory, ensuring that holding times are not violated.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory, in accordance with the corresponding section on sample identification. All sample containers will be placed in a solid, durable shipping container. Insulated ice chests will be used for laboratory samples that must be kept cold. The following outlines the packaging procedures that will be followed:

- Line the bottom of ice chests with bubble wrap to prevent breakage during shipment. A self-adhesive custody seal will be placed across the lid of each sample. For VOC samples, the seal will be wrapped around the cap. All custody seals will be signed and dated.
- All samples will be placed in ice chests with the appropriate traffic report and chain-of-custody forms or RAP packing lists. For ice chests that are shipped, all forms will be enclosed in a large plastic bag and affixed to the underside of the chest lid.
- Ice used to cool samples will be double sealed in two zip-loc plastic bags and placed on top and around the samples to chill them to the correct temperature.
- Each ice chest will be securely taped shut with nylon strapping tape, and custody seals will be affixed over the lid front edge.
- If samples are being shipped, the laboratory will be notified of the sample shipment schedule.

Each shipping label (e.g., Federal Express, UPS) will be completed in full and a copy of the shipping label will be kept on record for the purpose of tracking. Shipping labels will be securely attached to the sample container. Cold samples or samples with less than two weeks holding time will be sent to the laboratory by overnight delivery.

4.2 Field Logbooks

Summary of field measurement and sampling activities will be recorded in a bound site logbook, and entries must contain accurate and inclusive documentation of project activities. Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. A separate logbook will be maintained for each project.

Logbooks will have all pages permanently bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in waterproof black ink, and signed by the individual making the entries. Erasing is not permitted; errors will be single-lined out and initialed and dated. Language will be factual, objective, and free of personal opinions or other terminology which might prove inappropriate.

At a minimum, the following information will be recorded when the applicable procedure is being conducted:

- Sample location and description
- Site sketch showing sample location and measured distances
- References to photograph locations and numbers
- Samplers' name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Sample matrix
- Type of sampling equipment used
- Calibration of equipment described
- Onsite measurement data (e.g., PID, temperature, pH, conductivity, etc.)
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for groundwater: clear water with strong ammonia-like odor)
- Type(s) of preservation used
- Lot numbers of the sample containers, sample tag numbers, chain-of-custody form numbers, and chain-of-custody seal numbers

- Shipping arrangements (overnight air bill number)
- Recipient laboratory(s)

In addition to the logbook, an inventory of observed or reported chemicals could be conducted during site investigation. The inventory would record the type of substance (phase and name, or unknown), type of container, and estimated quantity.

4.3 Photographs

Photographs may be obtained at each field measurement/sampling point, every excavation, select sample locations, and at other areas of interest on site. A reference to each photograph will be entered in the field notebook. When a photograph is taken, the following information will be written in the notebook or will be recorded in a separate field photography log:

- Time, date, and location of photograph
- Description and number of the subject photographed
- Name of person taking the photograph

4.4 Bottles and Preservatives

All containers are from the laboratory and are pre-cleaned for one-time use. Preservatives, if required, will be added in the field or will be pre-measured in the sample container supplied by the laboratory. Sample container identification and sample preservation methods are covered in Tables 2-3 through 2-5, Section 2.8 of this QAPP:

4.5 Sample Traffic Report, Chain-of-Custody, and QA/QC Summaries

Traffic reports and chain-of-custody records are used to document sample collection and shipment to laboratory for analysis. All sample shipments for laboratory analyses will be accompanied by a traffic report and chain-of-custody record. Forms will be completed and sent with the samples for each laboratory and each shipment. If multiple insulated sample chests are sent to a single laboratory on a single day, a form for each chest will be completed and sent to

the laboratory. The traffic report and chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples.

Each chain-of-custody will contain the following information:

- Project name
- Sampler's name and signature
- Sample identification
- Date and time of sample collection
- Sample matrix
- Number and volume of sample containers
- Analyses requested
- Filtration completed or required
- Method of sample preservation
- Method of shipment
- Samples for internal matrix spikes and spike duplicates

A record of quality assurance/quality control (QA/QC) will be maintained in the field notebook. Sample numbers for all rinsate samples, reference samples, blanks, QC samples, and duplicates will be noted in the notebook.

SECTION 5.0

DATA MANAGEMENT

Atlantic Richfield will maintain a database including field and laboratory data. Data will be entered into the database following data review, validation, and verification.

5.1 Data Review, Validation, and Verification

The laboratory will provide analytical results in electronic and paper formats. In addition, the lab will provide copies of the supporting laboratory quality assurance documentation. At a minimum, data verification will include evaluation of sampling documentation and representativeness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method QC sample results, field duplicates and the presence of any elevated detection limits.

Validation and Verification Methods

The following will be addressed during the field and laboratory data validation process:

- Chain-of-custody forms and laboratory data sheets will be checked to verify that appropriate analyses were run and that the samples were analyzed within specified holding times.
- Review of duplicate and blank samples will be used to evaluate method precision by the laboratory.
- An overall review of the sample delivery group will be conducted to evaluate the overall quality of the data. Included will be a review for potential transcription errors, detection limit discrepancies, data omissions, and suspect or anomalous values.
- Electronic laboratory data will be checked against the hardcopy reports before being compiled in the database.
- The most recent data will be saved as an interim database spreadsheet until the data has been verified, then appended to the final database.
- Electronic data will be stored in a relational database within a secure server, which is backed up on a daily basis. Only authorized personnel with direct domain access and password will be able to access the database.
- Field data will be reviewed. Anomalous or suspect values will be noted and an explanation provided.

5.2 Reconciliation with Data Quality Objectives

An assessment of data quality will be performed to determine whether data generated are consistent with the investigation DQOs. If data are found to deviate significantly (several orders of magnitude) from previous analyses or surrounding conditions upon which the sampling program was based, the data may be qualified based on the validator's assessment of the usability of the data for the intended end uses.

5.3 Assessment, Response, and Reporting

Corrective action is required when potential or existing conditions are identified that may have an adverse impact on data quality. Corrective action applies to data management and both the field and laboratory procedures. In general, any member of the project team who identifies a condition adversely affecting data quality or procedures can initiate corrective action. Written evidence (e.g. field or laboratory logbook) will document and identify the condition and explain the way it may affect data quality.

A well-defined and effective policy for correcting quality problems is critical to the success of a QA program. While this QA program is designed to minimize problems, it must also identify and correct any problems that do exist. The corrective action system for the Yerington Mine project will include:

- Identify the problem.
- Identify cause of the problem.
- Identify corrective actions to correct the problem.
- Implement corrective actions.
- Verify effectiveness of corrective actions in correcting the problem.
- Document corrective action including:
 - Problem identified and cause.
 - Corrective actions implemented.
 - Effectiveness of corrective actions.
 - Samples impacted by problem.

Documentation of corrective actions with regard to data management will be included in the Data Summary Report.

SECTION 6.0

INSTALLATION PROCEDURES

6.1 Installation of Monitoring Wells

All monitor well boreholes will be drilled using a drilling technique that allows for lithologic logging of borehole samples to assist in the assessment of site hydrostratigraphy. All wells will be constructed to allow for the collection of groundwater elevation measurements and water quality samples. The Data Summary Report for groundwater Conditions will present all pertinent information from the well drilling and construction activities.

The wells will be constructed of nominal two-inch diameter, Schedule 40 PVC flush-coupled well casing and 0.02-inch slotted screens. Screened intervals (of a length to be determined in each Work Plan) will be installed in the saturated alluvium with a filter pack consisting of 10/20 silica sand. The filter pack will be extended above the static groundwater level measured in the borehole to an elevation sufficient to capture the estimated highest seasonal elevation of the groundwater table plus two feet.

The remaining annulus will be backfilled with bentonite or grout to the natural ground surface. The wells will be completed with either (a) a nominal two-foot casing above the ground surface or (b) a subsurface casing within a manhole or vault. The type of completed well will depend on the location and traffic within the area. All completed wells will be cemented in-place and locking caps installed at the top of the well casings.

Measurement of latitude/longitude coordinates and top-of-casing elevations for existing and new monitor wells will be conducted with a real-time kinematic global-positioning satellite (GPS) device. This portable device allows an accuracy of at least three millimeters (0.01 feet) for latitude, longitude, and elevation. This degree of accuracy is sufficient for water level measurements to be used in the calculation of groundwater direction and hydraulic gradient. Measurements of coordinates and elevations will be recorded in the field notebook immediately after readings are observed, and will be automatically logged in the GPS data-logger for later

down-loading and cross-checking of data recorded in the field. The coordinates will be used to properly position the wells on a site plan, along with a permanent record of each well top-of-casing elevation. For the purpose of field measurement, the top of the well casing will be the highest point on the rim of the casing.

6.2 Installation of Soil Moisture Devices

Soil moisture sensors will be placed in boreholes drilled to a predetermined depth below ground surface (bgs). Boreholes will be drilled with the smallest diameter auger possible, to allow for closest proximity with native soil. The diameter of the soil moisture sensors is approximately 1.5 inches. Soil cuttings or core borings will be saved for laboratory analysis of soil moisture and for sensor installation. Sensors will be installed at predetermined depth intervals as specified in the appropriate Work Plan.

The following procedure will be used to install the soil moisture sensors (NOAA, 2002; UMES, 1999):

1. Soak each sensor in clean water for 1 to 2 hours to remove the air and then allow drying for 4 to 6 hours. Repeat this step two times more.
2. Prior to placing sensors into the soil soak at least five minutes.
3. To install a sensor in the soil, first make a hole with a soil probe or auger to a depth a little deeper than desired.
4. To get good sensor contact with the soil, mix native soil from auger cuttings with enough distilled water to form four gallons of thick, semi-fluid mud with no visible air gaps.
5. Pour one gallon of mixed mud into the boring.
6. Position the sensor into the hole by lowering the sensor to the desired depth until the bottom of the sensor touches the mud.
7. Fill the hole around the sensor by adding the remaining three gallons of mixed mud, then some dry native soil and a little water at a time to enhance compaction, until the hole is filled to the depth of the next sensor level.
8. Allow at least one week for equilibration of the mud with surrounding native soil before recording the first "true" soil moisture measurements. To ensure equilibration, record the change in soil moisture every 12 hours, and graph results until the curve becomes relatively asymptotic.
9. Mark each sensor lead with a permanent tag indicating the exact depth of the sensor. Allow a minimum of six feet of lead to protrude from the ground surface.

10. Install an eight-inch diameter steel casing around the wire leads. The casing should extend from a minimum of one-foot bgs to two-feet above ground surface, and be open at the top, with no cap.

It is not a requirement that the sensor be calibrated directly with soil from each sensor location in each borehole. However, since soil profiles are typically made up of varying concentrations of elements and have different electrical properties, sensor accuracy is improved by soil-specific calibration. The improvement in accuracy due to soil-specific calibration has been estimated at approximately one percent.

Calibration is accomplished by collecting a soil sample (auger cutting or core boring) from each interval where a sensor will be placed, and pushing the sensor into the soil sample and recording the reading. The sample will then be laboratory-analyzed gravimetrically for water content. These laboratory data are combined with the sensor's electrical measurements to develop a soil-specific calibration equation.

Each lead from each sensor will be plugged into the meter, and soil moisture recorded. Readings from the meter will be inserted into the calibration equation to determine the true volumetric soil moisture. Data collected from the moisture sensors are analyzed by graphing the measurements. A series of readings taken over time are plotted to show changes in moisture level and trends throughout the soil profile.

6.3 Installation of Air Quality Monitoring Devices

The proposed air quality and sampling program at the Yerington Mine site has been developed according to the NDEP -- Bureau of Air Quality Monitoring Guidelines. PM₁₀ Samplers will be of the same type having the same inlet type and flow control. Inlets on all samplers will be between the range of 2 to 15 meters above ground and be at least 2 meters away from all structures possible obstructions to airflow. Samplers will be mounted on solid, stable structures that will not be moved by strong winds.

Also, there must be a minimum of a 270-degree arc of unrestricted airflow around each sampler. The predominant wind direction for the season of greatest pollutant concentration potential from the facility must be included in the 270-degree arc (NDEP, 2000).

Locations and Monitoring Pathways

Each monitoring site location will be as specified in the Work Plans. Monitoring path limitations are necessary in order to produce a path concentration representative of the measurement scale and to limit the averaging of peak concentration values. In addition, the selected path length (distance between the emission source and the sampling device) will be long enough to encompass plume meander and expected plume width during periods when high concentrations are expected.

To ensure that monitoring path data are representative of the intended monitoring objective(s), specific path siting criteria are needed. 40 CFR part 58, Appendix E, contains specific location criteria applicable to monitoring paths after the source and sampling locations have been identified. Criteria for the monitoring path are given for horizontal and vertical placement, spacing from minor sources, spacing from obstructions, spacing from trees, and spacing from roadways.

To control the sum effect on sample collection from all the possible interferences which exist around the monitoring path, the portions of a monitoring path that are affected by obstructions, trees, or roadways must not exceed 10 percent of the total monitoring path length (EPA, 1998c).

Mid-volume sampling will be conducted, with a flow rate of 113 L/min (4 ft³/min). Teflon filters (47mm diameter) will be used, to facilitate XRF spectroscopy for metals analysis. All calibrations, sampling, and analysis will be conducted in identical manners for all samplers.

During installation, certain information will be recorded from the samplers and filters. This information includes the following:

- Sampler identification (serial # or other ID)
- Run date
- Filter serial number
- Elapsed run time (minutes)
- Actual flow rate (m³/min)
- Standard flow rate (m³/min)
- Tare filter weight (g)

6.4 Installation of Meteorological Stations

Selection of the meteorological station should consider those obstructions that can affect instrument performance, such as vegetative canopy, water bodies, frequent dust storms, and buildings or other structures. Meteorological station equipment will be mounted to a tripod with a maximum height of 10 feet. The base diameter of the tripod is 10 feet. The leg configuration of the tripod will be adjustable for uneven terrain. The unit should withstand a sustained wind of 70 miles/hour and gusts of 100 miles/hour.

In general, the meteorological station instruments will be installed according to the manuals supplied by the manufacturers. The major components of the meteorological station may include:

- Control system and datalogger
- Charger and regulator
- Transformer
- Sealed rechargeable battery with mounting
- Weatherproof enclosure with conduit
- 20-watt solar panel (optional)
- 10 foot tripod with grounding kit
- Wind Monitor for recording wind speed and direction
- Wiring
- Aluminum crossarm sensor mounts
- Temperature/RH probe

- Solar radiation shield for temperature and RH probe
- Silicon pyranometer (optional; this instrument is typically used in solar radiation applications such as plant growth and evapotranspiration investigations)
- Rain gage
- Tipping bucket snowfall adapter with antifreeze
- Interface and serial cable for downloading data
- Datalogger software

The data logger attached to the instruments will be initially programmed to sample every 2-seconds and write data every 10-minutes and at 24-hours. Depending upon the desired data output, the data logger sampling program can be modified. If the data from the station is to be used in conjunction with ambient air sampling data for air quality purposes, then the amount of "down" time (for maintenance or calibration) will be observed and documented. The down time will be limited to equal to or less than 10% of the total time frame over which air quality monitoring is being conducted. This is in accordance with Nevada Ambient Air Quality Monitoring Guidelines, which state that "all meteorological data collected will be recovered at a minimum rate of 90% of the total data possible on an annual basis for each variable being measured" (NDEP, 2000).

Hourly averages of meteorological parameters are required to be reported to the Nevada Bureau of Air Quality. For meteorological monitoring data, the Nevada Ambient Air Quality Monitoring Guidelines state that "at least 30 minutes of valid observations are required to represent an hourly average. If 15-minute averages are used for compiling meteorological data, then at least two valid 15-minute periods are required for an hourly average. The minimum meteorological data sampling frequency of 360 samples per averaging period is met by electronically sampling equipment output at least once every 10 seconds for hourly averages or at least once every 2.5 seconds for 15-minute averages. A sampling frequency of once every two seconds is recommended (NDEP, 2000).

Maintenance and Calibration

The manufacturers' recommended maintenance and calibration methods for various meteorological components are described below. The wind monitoring instrument will need to

be sent to a lab once per year for inspection.

- RM Young 05305 Wind Monitor-AQ – Have qualified lab inspect bearings annually.
- Model SP-LITE pyranometer – Routine cleaning, no special requirements.
- Model TE525WS 8-inch diameter rain gage – Routine cleaning in the field, optional lab calibration annually.
- CS705 snowfall adapter for the TE525WS 8-inch diameter rain gage – Routine cleaning in the field and periodic changing and disposal of antifreeze.
- Model HMP45C temperature and relative humidity probe – Routine cleaning in the field.
- Electrical Equipment – Keep free of moisture.
- Batteries – Periodically check fluid and charge, change when necessary.

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